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NATURAL SELECTION AND THE DISPERSAL OF SPECIES

By EDWIN BINGHAM COPELAND
(From the College of Agriculture, University of the Philippines, Los Baños, P. I.)

We all cherish and esteem the truth. Those of us engaged in educational work and in scientific pursuits are devoted to the discovery, understanding, and promulgation of the truth, but our effectiveness in this work is somewhat qualified by individual and general peculiarities of mental equipment. Aside from the individual extremes of attitude, such as, on the one hand, that of the man who has such confidence in the stability of the truth that he trusts it to rise triumphant after every assault, and, on the other hand, that of the miser who treats it as one famous miser did his cheese, as something too precious to be exposed to the light, there is a very general disposition, based on the common love of novelty and contempt for the familiar, to value truth in proportion as it is unknown, unfamiliar, or unaccepted. The bizarre always attracts attention. Nobody publishes the fact that two equal two, or that two plus two equal four; and the demonstration that the square on the hypothenuse is equal to the sum of the squares on the other two sides of a right-angled triangle would attract no attention and is only published in elementary geometries. On the other hand, a plausible argument against the last proposition would be published and widely circulated and would attract considerable attention, even if it were not believed. No one pays any attention to the accepted fact that parallel lines will not meet, but a geometry based on the assumption that they will meet is widely heralded.

The general principle of natural selection has been accepted as an established fact for the past fifty years, and for twenty or

thirty years it has been accepted as truth so definitely established and generally accepted that any evidence, that is subject to construction as impairing its validity, attracts an undue amount of attention for this reason alone, and is likely to be accepted by those to whom the novel appeals with special force, and by others who may have escaped thorough grounding in the evidence for natural selection. The latter class is a larger one than it was some time ago, because the practically universal acceptance of natural selection has seemed to make unnecessary the presentation of evidence for it with the thoroughness that was customary when it was a subject of dispute, or while it also made an appeal on the basis of novelty. As examples of ideas that have made their appeal largely on the basis of their assumed value as evidence against natural selection, there may be mentioned the determinate variation heresy based on geological evidence, and the mutation idea, when extended beyond its author's intention and construed as having any relation to the validity of the natural-selection principle.

In general, such attacks attract little or no attention from those whose belief in natural selection is thoroughly grounded, for the reason that the iteration of familiar truth is not always welcomed, and that in general, any argument against a principle that seems to those who appreciate it to be absolutely unassailable, seems hardly worth replying to. In spite of these two ideas, it seems to me that, for the sake of economy itself, it is occasionally worth while to defend a principle even as widely accepted as that of natural selection, for the simple reason that intelligent but unqualified acceptance of really fundamental principles is always conducive to the efficiency of investigation, and that if scientific heresy be too completely ignored, the weakening of real scientific foundations may reach a troublesome point. Therefore, at the risk of placing myself in the unpopular position of an Aristides, I expressed myself publicly regarding the unreasonable application of the mutation theory, while it was new. Too little attention to this and other similar publications about the same time and the continued entertainment of the novelty of an idea that could be entertained as in opposition to natural selection have let the errors grow and have recently justified the publication of more careful and extensive work in contradiction of the same kind.

There comes now Dr. John C. Willis, who, as an excellent botanist, has accumulated a mass of throughly established and very interesting information—valuable if properly construed as collateral evidence on the general principle of natural selection,

but which he construes as opposed to this principle.[1] This evidence has been published from time to time, always with the implication which seems to me to be clearly a mistake, until it seems to be well worth while to point out that this mass of information has its value in the field of science that has its basic principle in the doctrine of natural selection, but has no value whatever in opposition to this doctrine.

Doctor Willis's early attacks on the theory of natural selection were devoted primarily to the support of the mutation theory and its application to questions of survival. In making the facts then at his disposal seem to invalidate the theory of natural selection, he made demands upon the theory that seem to me quite unfair, and then proposed that the theory be discarded, because its supporters could not meet these demands. For example, in the Annals of the Paradeniya Royal Botanic Gardens, volume IV, page 3, we find (italics mine) :

> Now, upon the theory of natural selection of infinitesimal variations, it is evident that any structure whatsoever must be *capable of being shown* to be or to have been—
>
> (1) Of some actual use now; or
>
> (2) Of some use in the past, in its present or in a different, and perhaps larger (less aborted) form; or
>
> (3) Correlated with some useful structure, whether visible or not.

I will agree that, upon the theory of natural selection, any structure must be of use, have been of use, or be present as a result of correlation. Perhaps, if it be of use, it is capable of being shown to be of use. But by whom? To demand that any particular person or any one generation explain the uses of all structures is to demand omniscience. It is no more the fault of the theory than it is of the structure, if its interpretation escape us. I believe that the use of the great majority of

[1] 1. Some evidence against the theory of the origin of species by natural selection, etc. *Ann. Roy. Bot. Gardens Peradeniya* 4 (1907) 1–15.
2. Further evidence against the origin of species by infinitesimal variations. *Ibid.* 17–19.
3. The geographical distribution of the Dilleniaceae, etc., *Ibid.* 69–77.
4. The floras of hill tops in Ceylon. *Ibid.* 4 (1908) 131–138.
5. On the lack of adaptation in the Tristichaceae and Podostemaceae. *Proc. Roy. Soc. London* B. 87 (1914) 532.
6. The origin of the Tristichaceae and Podostemaceae. *Ann. Bot.* 29 (1915) 299.
7. The endemic flora of Ceylon, with reference to geographical distribution and evolution in general. *Phil. Trans. Roy. Soc. London* B. 206 (1915) 307–342.
8. The evolution of species in Ceylon, with reference to the dying out of species. *Ann. Bot.* 30 (1916) 1–23.

familiar structures is understood at the present time. Additional structures are being interpreted in terms of utility from time to time. I can remember when the serrate leaf-margin was apparently a good example of a distinctive structure presumed to be beyond the reach of selection; but, for the past decade, the serrate margin has been understood to be useful under particular conditions and to be correlated in usefulness with other adaptive structures.

Doctor Willis continues to preach mutation in his latest paper, and I would argue at greater length against the application to natural selection of his opinions on mutation, if it were not that he has himself presented with striking clearness a conclusion which does away with any necessity of argument on the subject. In the Philosophical Transactions (pp. 329, 330) he says:

> We have no criterion to go by, by which to affirm that a certain specific difference is "small" and another "large." We have no right to say, for example, that if a leaf of one species is simple and of another compound, this is a larger difference than if one is pinnatifid, the other pinnatipartite. We have not the least idea whether the changes in internal construction of the nucleus necessary to form Jordanian species are in any way different from, or smaller or larger than those necessary to give Linnaean species.

And a little farther along,

> We must simply take account of all definite and hereditary differences, whether we consider them large or small. Every one appears to imply a mutation, but whether some mutations are large and others small, we have no idea, for we do not know in what a mutation really consists.
>
> It seems to me better to adopt the hypothesis that any specific difference may appear at one step, whether it be large or small. But we may go further than this, and claim that even "larger" differences than any we have as yet discussed may also arise at one step. For instance, the endemic Coleus elongatus on the top of Ritigala differs so much from all other Colei in its equally toothed calyx, and raceme-like inflorescence, as well as in other points, that it must probably be regarded as almost, if not quite sub-generically distinct. Yet the whole species is confined to the summit of this one mountain and exists there as about a dozen individuals, a number which can never have been much exceeded, if at all; and it must in all reasonable probability have arisen there at one step.
>
> But even with the formation of a sub-genus the possibilities of single mutations do not cease. * * * The distinction between genus and species is really more or less artificial, depending upon our ideas as to what are large and what are small changes.

With these ideas, I am in most complete accord. As long ago as 1904,[2] I concluded (p. 426) that "Mutations, or discontinuous variations, and the most insignificant of individual variations

[2] The variations of some California plants. *Bot. Gaz.* 38 (1904) 401–426.

are parts of one unbroken series." The distinction between genus and species is certainly artificial. So, likewise, is any attempt to frame a definition of a species by which one may decide what differences are specific, what are varietal, what are Jordanian, and, without prolonged study, what are merely incidental and not hereditary at all. There is no way of distinguishing between big and little specific differences nor between big and little differences that are not specific. Certainly, we may affirm that some differences are big and some others are little; but, between the big and the little ones, nature presents an absolutely continuous series of intermediate differences, which we can surely find, if it is worth our while and we exercise sufficient patience.

In the recent paper which most completely summarizes his views,[3] and which presents facts and methods of presentation of such value that they deserve careful attention, Doctor Willis places in apparent opposition to the theory of natural selection, the theory that the commonness of species and the distribution of species is a function of their age.

In the Flora of Ceylon by Trimen and Hooker are notes by Trimen indicating the commonness or distribution of all Angiosperms, except *Gramineae* (for which family Doctor Willis has himself made these notes), by classification into six groups, which in their order are Very Common (VC), Common (C), Rather Common (RC), Rather Rare (RR), Rare (R), and Very Rare (VR). "Very Rare" means very local, and, on the whole, the classification refers more to distribution than to local abundance. Doctor Willis has extracted and tabulated these notes on distribution, in connection with the preparation of his Revised Catalogue of the Indigenous Flowering Plants and Ferns of Ceylon, and the analysis of all these statements is presented with consummate clearness in a series of tables.

In making these analyses, he has classified the indigenous plants of Ceylon under three heads: First: Endemic species; second: Species confined to Ceylon and Peninsular India; and third: Species of wider distribution. His tables show conclusively (p. 311) that:

> "In general the rarest plants in Ceylon are the local endemics, and the commonest those of wide distribution. This is not at all the result that one would expect had the endemics, as is usually supposed, been developed by the aid of natural selection to suit the local conditions." From

[3] Phil. Trans. Roy. Soc. B. 206 (1915) 307–342. Page references not stated to be otherwise are to this paper.

these tables and his discussion, he makes two chief conclusions (p. 320), "The first of which is that the local endemic species have not been—as I have already shown in other ways in other papers—developed in any kind of advantageous response to local conditions, as must have occurred did natural selection obtain." To this conclusion, we will return later.

(p. 325) "The second conclusion that we may, I think, justly draw from the remarkable Tables which have been set out is that, on the average, the commonness of a species depends upon the time that has elapsed from the period it was first evolved in, or arrived in, the country." And again (p. 340), "The second conclusion drawn is that on the average the commonness of a species depends upon its age from the .time of its arrival in, or evolution in, the country. The commonness of any individual species will, of course, also depend upon its degree of adaptation to local conditions, and upon many things which can only be regarded as chance, such as the sudden appearance of new factors, like diseases, etc., in the problem. In other words, on the average, species are developed quite indifferently to local conditions, though it is possible that they may be developed because of those conditions."

It is the second of these conclusions which unquestionably follows from the figures that Doctor Willis has collected and so clearly presented. This general idea, that geographical distribution and the age of species are correlated, was explained and used by Doctor Willis in 1907 [Annals of Royal Botanic Gardens, Peredeniya, 4 (1907) 69–76]; and in the paper now under discussion, page 338, he says:

> In 1907 was the first time, to my knowledge, that they were put forward in so many words, and a proper understanding of them will make a great difference in the handling of problems of geographical distribution.

As Doctor Willis notes, "there is nothing surprisingly new about these views." In the preceding year,[4] I had made use of the same views, and had done so without reference to literature, because, as far back as my student days, at least two of my professors explained them to us as commonly accepted principles. In the paper just cited, page 62, I note:

> Even geographical characters are useful. The whole of the character of not a few genera, as *Prosaptia*, *Niphobolus*, and *Acrostichum*, is intelligible when, and only when, the habitat is included and recognized as the dominant character of all. More broadly geographical characters are of value too, for no plant has progeny in places inaccessible to its reproductive structures. The relative antiquity of groups, as definable by their present characters, is important evidence in judging their relationships. If a species or genus is confined to one locality or one part of the world, it is probably not very ancient. If it has a very wide and continuous distribution, its age cannot be less than sufficient to permit such a dissemination. Our oriental *Prosaptia*, *Acrosorus*, *Loxogramme*, "*Schel-*

[4] The comparative ecology of San Ramon Polypodiaceae. *Philip. Journ. Sci.* 2 (1907) *Bot.* 1–76.

lolepis," *Niphobolus, Drynaria, Dryostachyum, Thayeria* and *Lecanopteris*, and the American *Lepicystis, Campyloneuron* and *Phlebodium* must all be younger groups than the cosmopolitan *Polypodium*, ancestor and cousin at once of them all. A group with wide and discontinuous distribution must be ancient enough to have become widely distributed, and to have died out in the intermediate territory; it may not be older than a group with equally wide continuous distribution, but its minimum probable age is greater.

The relation between commonness in one country and distribution outside that country has not been in the past so well appreciated as the relation between age and distribution, but is made equally clear by Doctor Willis's tables. It is unquestionably true that in almost any country such a relation exists, and a little reflection suffices to show that it must in general exist. Without ever putting it into words, I have for years acted on the assumption that there is such a relation. It has repeatedly happened that after describing a species from a single collection, under the impression that it was quite local, and after a reasonably careful search for previous description elsewhere, I have found the plant to be rather common in the Philippines, and have then made a renewed search for previous description from some neighboring land; the idea being exactly that which Doctor Willis has demonstrated to be sound—that a species common and of rather wide distribution in a given island, or group, or region, is therefore to be expected to occur in other islands or regions. Locally extensive distribution and commonness are evidence both of considerable age and of the ability of the species to maintain itself and to spread, and age and the ability to spread are in themselves reasons to consider it likely that the plant has spread extensively.

For the sake of emphasis, I repeat that both *time* and the *ability* to survive and spread are necessary in order that any plant can have become widely disseminated. In the four-year course of our College of Agriculture, some students graduate in three years, some graduate after five years, while the largest number of those who enter the course graduate in four years or disappear without finishing the course. In determining when any student will graduate, time is one paramount factor. There is probably no human being who could finish the course in one or two years; but, because time is a paramount consideration in determining who will graduate during any given year, shall we conclude that ability has nothing to do with it? Surely not. In the case of any given student, the date of graduation is fixed by the date of entrance, by his ability, and by other considerations (sickness or death, for instance); and the fact that time is

indispensable does not in the least impair the fact that fitness is also indispensable. The student uses his time according to his ability, and his fitness for the work of a student becomes effective as time passes.

Now, likewise, in the case of plants, if the plant be without fitness, time avails it nothing. Assuming the plant to exist, but without fitness to endure and to spread, it stands still for a longer or shorter time and finally disappears. The doctrine of natural selection and survival is a rational one; but would not be so, if it ignored time. The fitness of any plant is merely ability to make use of time in which to survive, to spread, and eventually to keep or to become adapted to the conditions under which succeeding ages find it. There could be no sane doctrine of natural selection without consideration of the element of time; and the early fight of the idea of natural selection for general recognition was forced primarily by the necessity of past time for the possibility of the evolution that natural selection postulated.

Now, if we recognize, as I do not see how we can possibly escape doing, that the demonstration of a relation between time and geographic distribution not only does not impair the doctrine of natural selection, but is rather an indispensable and inevitable corollary of the theory of natural selection and a consideration that must be taken into account in the application of the theory of natural selection to the understanding of the bionomics of any single plant or structure, I believe there will remain nothing in this paper by Doctor Willis that consititutes an argument against the doctrine of natural selection or that offers anything but an invitation for the investigation of particular problems in the application of this doctrine.

To some of these applications, I will return presently. First, however, let us note that the difference in view between Doctor Willis and myself lies again in the demand made upon the doctrine of natural selection or, in other words, upon what we mean by this doctrine. To me, the proposition is simply that those plants survive that can—where, when, and while they can. Their presence is obviously necessary before they can begin to survive. To Doctor Willis, the doctrine of natural selection is something which ought to explain the initial presence of the plants. In passage after passage, he recognizes the necessity of fitness for ultimate survival, sometimes without reservation, sometimes with decided qualification for another element classified as chance; thus (p. 341):

"Species do not, so far as we can tell, appear in any sort of advantageous response to local conditions, which are the only conditions that matter when they first appear. Having appeared, a species will, or will not, spread, according to its suitability to local conditions. In each locality the ultimate commonness of a species will depend upon its degree of adaptation to the local conditions, and to a large extent, on chance." And from the paper on the *Dilleniaceae*, "Dillenia ovata was perhaps the first, or the best adapted, for it has spread comparatively widely."

Regarding myself as a confirmed adherent of the doctrine of natural selection, I do not hold it in the slightest measure *directly* responsable for the origin of any species. Species originate by variation. There is not the slightest doubt that in very nearly all cases—if not in quite all cases, the exceptions have never been well demostrated—variation is indiscriminate in direction. Now, if any man chooses to define a mutation as a variation that gives rise to a new specific character, then, certainly, species originate by mutation exclusively. My own objection to this use of words is that they are newer than the ideas they would express, are therefore superfluous, and consequently are a nuisance. There is nothing new in holding that the mutations are independent of natural selection, since the variations have always been held to be so. Doctor Willis maintains that the species originate by mutations which occur independently of fitness. The older idea is that the species, or characteristics, originate by variation, independently of natural selection. Neither the validity nor the scope of the doctrine of natural selection seems to be seriously impaired by the substitution of the novel word. When any man distinguishes a mutation from a variation by a usable definition, it will become possible to see whether the change of words is justified and to test its effects. The author of mutations (de Vries) presented no such definition, unless it be the one already suggested, that a mutation is a variation which produces a specific character; as to the latter, de Vries took us back to the starting point, from which we might wander around the circle *ad libitum*, by identifying specific characters by their origin through mutation. If any subsequent writer has identified mutations more intelligibly, it has escaped me; Doctor Willis, at least, will hardly attempt this, in view of his clear recognition of the inherent hopelessness of attempting to draw any line between small differences and bigger ones, between the measure of incision of a leaf-margin and the characters that are used to distinguish species, genera, and even families.

While the choice of diction as between mutation and variation has properly nothing to do with the recognition of natural selec-

tion, it is genetically associated with the scope of our idea of a species; and approaching the subject from this point, I may come again into agreement with Doctor Willis, and this time on his own ground. There is a constant tendency among both botanists and zoölogists to place an ever finer construction on the idea of a species. Each decade sees the recognition as species of many groups of plants which previously were combined with other groups, either as varieties or without even varietal distinction. In some cases, this change is due to more careful investigation of resemblances and differences, but frequently it is merely the expression of a change in attitude as to what a single species should include. The extreme in this direction was reached years ago by Jordan, in the recognition of what are commonly referred to as Jordanian, in distinction to Linnaean, species. As a matter of fact, no botanist of to-day holds himself to the Linnaean idea. If the present tendency continues unchecked, our descendants will all find themselves following Jordan's policy. In practice, I do not expect the tendency to extend so far. Such a practice applied to all plants would make systematic botany a subject inconveniently vast and cumbersome, even for the larger number of botanists that may be expected in future years. In the case of the very great majority of plants, the recognition of Jordanian species, supposing that they exist, would serve no useful purpose. In the case of such plants as rice, and other plants of great industrial importance, it will be worth while, and will surely be done, whatever the nomenclatorial rank the forms may be given.

Our nomenclatorial divisions—families, genera, species, and varieties or forms—are, as I have repeatedly pointed out, in part functions of the diagnostic peculiarities of plants, and in part functions of our convenience. The old idea, that a species is a group of plants distinct from any other group, in the sense that we know no practically continuous series which connects it or has connected it with any other group, was never anything but an expression of contemporary ignorance, and is as dead to-day as the idea that the species were separate manifestations of the Creator's activity. This is as true of genera and families as it is of species. "We would still want to recognize genera and species, if the tree of life could be reproduced in every detail." [5]

As we fill in our skeleton structure of the tree of life, it is convenience that must determine what genera, species, and other

[5] Philip. Journ. Sci. 8 (1913) Bot. 153.

groups will continue to be recognized. As we fill in the finer details, suppose that we recognize the twigs as species, shall we recognize the leaves as well? The leaves are parts of the whole structure, but are transient in their nature. Eventually, the most of each season's twigs, on each individual tree, also die and fall. Of the species that occupied the world five million years ago, some may survive, but the most have doubtless disappeared. Working in any particular age, as we have the opportunity to work in our own, we may identify each recognized twig of the tree of life as something that for our purposes, extending over a period of generations, is established, and we may give it a specific name. But, again, what shall we do with the leaves, of which each season perhaps yields its own crop?

To my mind, this figure of the tree of life is appropriate and useful. Granted that we retain the finest twigs as species, the leaves are each season's crops of variations. As the morphologists distinguish easily in general between leaf and twig, so the systematic botanists can distinguish in a general way, although with less accuracy and with more difficulty, between the fluctuating variations and the recognized species, which hold their own through the time with which we are acquainted, and are widely scattered. Yet, there is no sharp line between these. Of each season's crops of variations, the most disappear in their turn as regularly as they present themselves; yet of each season's crop, some variations in form perpetuate themselves for a longer or shorter time—some for one more generation, some for several generations, and so on up to what in a practical sense we refer to as "forever." There is no sharp line between the most temporary variations and the most lasting. And in selecting among the plants that manifest these forms of varying distinctness and durability those which we will recognize as species, convenience is the only ultimate criterion that can possibly guide us.

In each locality, each species produces its own crop of varying offspring. In each season, each species that occurs on a number of islands or a number of mountain tops produces in each locality its crops of variants. Some of the variations are so slight as to escape any attention that they might receive. Others, the visiting or resident botanist notices, but ignores as of little importance. Others are more striking. If they impress him as sufficiently marked, he describes a new species. What constitutes sufficient markedness depends on the idea of propriety held by the individual botanist. Visiting one of our mountain tops, Linnaeus would have found a few species; Jordan, a very large

number. Even Linnaeus, if he could have visited all our tropical summits, would certainly have described some species that a visit a few years later would fail to relocate.

For the particular plant forms found at a given time in a given place, natural selection may or may not be responsible. If they have been there for a long time, they must have been fit. But for the plants that appear this season as an expression of indiscriminate variation—usually slight, but with increasing rarity increasingly conspicuous—natural selection is not responsible. If a botanist, visiting a mountain summit, discovers a peculiar plant which he knows has originated in the course of this year's variation and which he knows will disappear with the death of this year's generation, he may or may not describe it as a new species, depending upon his general attitude or his chance humor. It is perfectly possible that he foresee the fate of this "species." Willis states that *Coleus elongatus,* confined to the summit of Ritigala, is represented by not more than a dozen individuals. Unless it is protected by authority, an ambitious collector will some day exterminate this plant, and, in so doing, secure particularly valuable material for sale or exchange. One of the California botanists, some years ago, described a new species and refused absolutely to tell any other botanist where he found it, stating that there were but few plants and it would be exterminated by collection.

In the overwhelming majority of cases, the botanist cannot foresee the extinction or survival of any given rare and local species. He describes what looks distinct enough to appeal to him, as a species, and lets it take its chance. Now, remembering that the striking form which makes its appeal as a species is at the time of its first appearance perhaps nothing but the extreme of a series of other and minor variations, and that it is the individual botanist's judgment which decides how extreme the given variation must be to constitute a species, and that natural selection has, according to old theory, nothing to do with the occurrence of these forms in the first place, it follows that the number of species which exist completely independent of natural selection, so far as their distinctive characters are concerned, depends upon nothing except the judgment of individual botanists. If we were to split so finely and industriously that every variant were given a specific name, then an almost infinite majority of our species would exist independently of natural selection. If it were possible to know the history of each kind of plant and to restrict ourselves to the description

of those distinctive forms that have endured for a long time, and to recognize these, and these only, as species, then natural selection would be responsible for them all.

Obviously, our opportunities, our judgment, and our convenience all combine to make us adopt a middle course. A very considerable proportion of new species are described from single plants. It is far from unheard-of for two species to be described from a single plant. In the groups that vary widely, of which I presume that the genus *Crataegus* is one, it is probably not unusual for more than one species to be described from the progeny of a single plant. Up to this time, such a practice has not been adopted, except in cases where the parentage is unknown. If the same freedom of species-recognition and description were practiced with various cultivated plants, for example, tobacco, where the parentage is known but the offspring vary beyond the bounds that would be recognized as specific among wild plants of unknown parentage, there would be almost no limit to the number of species; but systematic botanists have so far mercifully abstained from doing this.

The responsibility of natural selection for the species recognized at any moment in a given place depends then very largely upon what we recognize as a species. The possible origin of species by the summation or selection of variations, whether slight or great, is another question to which the answer is fixed chiefly by our choice of definitions. In so far as the species originates by a single variation—which may always be true, if we define species in that way—natural selection is never responsible for its immediate appearance. Even if we go as far as the veriest determinate-variationist might, and assume that species N has been derived from the species A, through B, C, D, E, etc., all steps being in the same direction, and the most of the steps being individually short enough to escape our notice, still each of these intermediate forms by the definition just suggested is itself a species, and N, in its turn, originates by one variation from the different parent species M.

That the species which occupy the world to-day have originated by the selective accumulation of relatively small differences, it is not worth the mutationist's while to deny. None of them will waste his time looking for an Angiosperm as the mutant of a Flagellate, nor will any mutationist be disposed to deny that between these extremes there has been a large number of intermediate steps. If we agree with Doctor Willis that the only difference between little steps and big steps is one of degree,

and that even the degree is beyond our power of measurement, the particular number of steps between the Flagellate and the Angiosperm loses all possible importance. We may then agree that, on the one hand, the species that occupy the world to-day are, each and every one of them, products of an exceedingly long series of selected variants or mutants; but, at the same time, we may also all agree that species may be so defined that natural selection is never immediately responsible for their origin.

In conceding that natural selection may not be immediately responsible for the origin of the "species" we may discover, I am not detracting one particle from the claim that it is ultimately responsible for the presence of every plant and for every typical and normal structure of every plant that any man can find anywhere in the world. Among each season's crop of variations, a few may endure because they are particularly fit to endure. These are naturally selected. The vegetation of the world to-day has been selected, and reselected, countless times, out of the crops of each season of past time. Though we may define a species in such a way that natural selection is not this year responsible for the majority of the species on any particular mountain top, there is no mountain top where it is not responsible for practically the whole of the vegetation—responsible for its particular form as well as for its presence. By defining species in a way that removes a large part of them from the scope of immediately past selection, we leave the vegetation of the world made up—as it actually is—almost entirely of a small minority of all species. For the vegetation of the world in every conspicuous aspect and attribute, natural selection is entirely responsible; and even though we accept definitions that make natural selection not responsible for single specific characters of single small groups of plants, we still leave it responsible for the most of the characters of every individual among these plants, and leave it (natural selection) with entire ultimate responsibility for the presence of each, even of these rare exceptions; for, without the sanction of natural selection, their parents would never have born progeny.

I turn now to a few of the details of Doctor Willis's papers.

Quoting from page 328, "In cases where we get two large and well-defined groups in a family, we may compare their degrees of rarity, when the difference between them is what is usually looked upon as an adaptation. For example, in the Rubiaceae it is usually supposed that the sections with fleshy fruits are more recent than those with dry. But on the other hand the *former* is supposed to be an adaptation to enable the seeds to be easily dispersed." And from page 329, "It is evident that the fleshy fruit has

not proved of any special value to its possessors, and is probably a more recent development. There are many other so-called adaptations in many other families which can be dealt with in the same way. Always the figures go to show that evolution of forms is on the average indifferent, and that these so-called adaptations are of no special advantage to their possessors."

Now, if we agree that the *Rubiaceae* with fleshy fruits are more recent than those with dry fruits, this alone might be responsible for the greater abundance of species with dry fruits, in spite of more perfect adaptation on the part of those with fleshy fruits. In reality, however, this does not hit the kernel of the matter. The fact is that the dry fruit is also an adaptation, just as much as is the fleshy fruit. One is adapted to one set of conditions, the other to another set, and the two sets of conditions may perfectly well be encountered at the same time and in the same place. A perfectly parallel situation is presented by the structure of the pileus of the Agaricales. As Buller has beautifully shown in the Pfeffer Festschrift, most of the species of *Coprinus* have one type of structure and behavior, while *Psalliota* and nearly all of the other *Agaricaceae* have a different type, the two differing in almost all possible details, even down to the finest, but both being recognized by Buller as highly and appropriately specialized, the two occurring side by side without the slightest prospect that either will drive the other out.

It is important to each group of plants, for the sake of the completest possible success in holding what place it has and in spreading, that it occupy every available habitat, make use of every available means of dispersal, and make the most of each factor that will insure the reproduction of any of its members. The fact that some *Rubiaceae* are adapted to dispersal by the characters of their dry fruits does not make it at all a disadvantage that related plants of the same family be adapted to the same end by the possession of fleshy fruit. The family is better off with two general methods than it would be with one general method. In each generation, the family as a whole is safer because every possible method is taken advantage of by some of its members. The members that scatter their seeds by the medium of fleshy fruits are, in this respect at least, out of competition with those that scatter their seeds by methods depending upon the dryness of their fruit. To this extent, the family can have more members and be more successful, because in this respect competition within the group is removed.

Years ago, my friend Professor Peirce [6] undertook to argue that the algal constituent of a lichen gained nothing from the association with the fungus, even though it was enabled to live in places, that without this association would be inaccessable or intolerable. To make his point perfectly clear, Professor Peirce makes use of "A homely analogy. A cow would never climb to the top of a twenty-story building, but once elevated to this position in opposition to her ordinary habits and to the force of gravitation, would she be any more advantageously placed than her more commonplace relatives in barn or pasture?" A Chinese student in this college once presented, as a piece of English composition, the story of an imaginary dream, in which he saw the vacant places of the earth occupied from time to time and made productive for the use of men, until every desert was watered and every rock covered with a mantle of soil. The mountains were leveled to an altitude where rice could be produced; and finally even the seas were bridged, and the bridges covered with soil and made to produce their crops of rice.

The Chinese boy's imaginary dream is truer to life than the argument of the wisest professor who overlooks the fact that the one test of fitness, of appropriateness, is survival. As the struggle for food grows keener, the time may indeed be anticipated, when no foot of the Earth's surface can well be spared from producing its portion for our use. That time has not yet come for us; but for the lichen, for the *Rubiaceae*, and for the cow, it is here, and it has been here so long that we can almost say that it always was. The twenty-story building is located where there is no room for cattle in green pastures; and where there are green pastures, there are already as many cattle as men think can thrive upon them. If the roofs of twenty-story buildings could really be made available as places for cattle, then more cattle might exist in each generation; and this, by the one final standard of judgment, would be an advantage to the race of cattle and would assuredly be of advantage to the individual cattle that lived because this peculiar habitat furnished them the opportunity. The algal constituent of lichens grows in places that are fit for it and within reach. If slavery to a fungus increases the number that can live, by furnishing a new place or a means to reach a new habitat, this is to the advantage of the gonidial species, as well as that of the individuals which live because of the opportunity the fungus offers.

[6] Proc. California Acad. Sci. III Bot. 1 (1899) 230.

Likewise, among the *Rubiaceae*, any method of reaching a new habitat is an advantage to the group as a whole, because it is of advantage to the members that acquire the method. Some may be specialized to scatter their seeds by means of the wind, some by floods, some by the use of various quadrupeds, others by the help of birds or even insects; each one of these methods, and each added method that may be developed, is an advantage. The structures adapted to each method or to the employment of a common method under varying conditions all survive and become numerous in the individuals that possess them, because they are advantageous; but it is not to be expected that any one of these will enable the plants that exhibit it to become more numerous than the plants that propagate themselves by some other equally desirable but different method. There are many families that have some members with dry fruits and others with fleshy fruits. Each of these methods is an adaptation to a common and wide range of natural conditions.

Doctor Willis's second paper against individual selection [Annals 4 (1907) 17] is chiefly devoted to the point that—

> While the characters that distinguish species and genera are largely characters of the floral organs, the struggle for existence is almost entirely among the seedlings and young plants, in which these organs are not yet present.

By the same argument, in a government school where expenses of every kind are paid by the state and only the brightest students are selected for promotion, the wealth of the parents cannot be a factor in determining who will graduate. Yet, everybody knows that, in schools of this type, it is often impossible for a poor man's son to graduate, simply because he can never be admitted. Flower and fruit structures surely do not take an active part in the competition between seedlings, but they determine the entries for this competition; and no one will claim that this is likely to be without influence on the result. The struggle between old trees probably is not keen. By the time the tree is grown, the fight is settled, so far as it is concerned, and is carried over to the next generation. The essential struggle of any individual is not to survive in itself but in its progeny. Tennyson knew all about this.

Quoting from page 323 (Philosophical Transactions),

> But we may go further yet, and take the two genera, *Doona* and *Stemonoporus*, which have 11 and 15 species respectively, and on the theory of natural selection would therefore be supposed to be especially suitable to the local conditions. They show:

TABLE XIX.

	Doona.	Stemonoporus.
VC	0	0
C	1	0
RC	1	0
RR	2	2
R	4	4
VR	3	9
	11 Marks 51	15 Marks 82
Rarity	4.6	5.4

And page 324,

TABLE XX.

	Number.	Marks.	Rarity.
Species of wide distribution	1,508	4,579	3.0
Species confined to Ceylon and Peninsular India	492	1,714	3.48
Mean rarity of all	.....	.....	3.49
Species endemic to Ceylon	809	3,518	4.3
Species of all 23 endemic genera	52	236	4.5
Species of Doona	11	51	4.6
Species of Stemonoporus	15	82	5.4

Such figures as these no ingenuity can torture into any kind of support for a theory of development of endemics to suit the local conditions.

These figures likewise throw no great light on the multiplication table, but do not therefore impair its validity nor jeopardize its general acceptance. For the understanding of this situation, it is not natural selection nor multiplication, but division, the effects of which need to be understood. There is no question that in the Philippines the commonest timber trees are the lauans, likewise dipterocarps, but there is a considerable number of species of lauans, and individually they are not exceedingly common. As to Ceylon dipterocarps, note the expression[7] "The Dipterocarpaceae, so common in Ceylon * * *." If *Doona* had a single species, it might be very common, and *Stemonoporus* might be common, or very common, if it were monotypic. There are no figures by which to decide how many times "very common" must be divided in order to produce "rare," but any man who has ever seen an apple divided knows that the portions are smaller than the whole. If *Doona* and *Stemonoporus* were as a whole only as common as other genera or as the mean of all Ceylon plants, then the fact that *Doona* is split into eleven species and *Stemonoporus* into fifteen would suffice

[7] Ann. Roy. Bot. Gardens Peradeniya 4 (1907) 18.

in itself to make each of these species a rather rare plant. The effect of this development of numerous species has probably been in each genus to increase the area available, and so the aggregate commonness. But the improvement in this respect cannot be expected to suffice to offset the rareness resulting to the single species from the fact of their considerable number, unless the differences between these single species are such as completely to remove them from competition with one another. This probably never happens in any genus. Therefore, in every genus, the more numerous the species, the greater their individual rarity. "When the genus contains one or two species only, rarity is 4, when it contains more than two it is 4.3" (p. 331). If this rather elementary application of mathematics does not torture the phenomena in question into any kind of support for a theory of advantageous evolution, it certainly leaves nothing that can be construed as in opposition to such theory.

As to the relative rarity of *Doona* and *Stemonoporus*, Doctor Foxworthy points out that *Stemonoporus* is a decidedly isolated group, while *Doona* is closely related to the widespread genera *Hopea* and *Shorea*. If *Stemonoporus* is the rarer, as well as the more isolated morphologically, this is another illustration in support of Doctor Willis's general thesis.

In several places, Doctor Willis notes the general tendency of endemic species to occur in the wet and mountainous districts rather than in the dry. Thus, page 319:

> It is also very noteworthy that in the dry zone there are only 28 endemic species against 743 in the wet, though the species of wide distribution are only in the proportions of 304 to 648, and the dry zone has twice the area of the wet.

There appear to be two valid explanations of this condition. The dry region is closer to the dry region of continental India, and there is, accordingly, a better chance for species to spread across the channel in either direction; that is, the dry region of Ceylon is much less isolated from the continent than is the wet region. A second explanation is that conditions are much more varied in the wet region and that any given set of conditions is much more restricted. If, therefore, a plant varies so as to produce a new species in any given spot in the wet region, its favorable field for dispersal is almost sure to be decidedly circumscribed, as compared with that of a new form adapted to dry-country conditions. High mountains are particularly "local" in their conditions, and, accordingly, in Ceylon, as is true everywhere in the tropics, each mountain of any age has

a considerable endemic flora. What we have here is merely a manifestation of the principle, which various evolutionists have strongly emphasized, that isolation is essential or at least favorable to the establishment of new species. "Isolation, *as isolation*, favours the production of new forms." [8]

Even this does not exhaust the explanations. On the whole, the plants of dry districts are probably more likely to scatter their seed to great distances than the plants of wet districts. Facility for wide dispersal of seed is of course conducive to commonness and inimical to prolonged endemism. And, still again, in a district where there are marked local differences of conditions natural selection tends to permit a wider freedom of variation than it does where conditions are uniform or comparatively uniform over considerable areas.[9] For this reason, variation being more frequent and wider in the more diversified wet region, more new forms, susceptible of recognition as species, are continually appearing there; and the more such forms appear, the more are likely to be perpetuated and to attain recognition.

Doctor Willis is also puzzled by the fact that (p. 319)—

> Adding up all the species of the dry zone, we find 472 confined to it with 1809 marks, or a rarity of 3.8; those of the wet zone only are 1692 with 6497 marks, or also a rarity of 3.8. But the species that occur in both zones, 645 with 1505 marks, are much commoner in both, and show a rarity of 2.3, i. e. are fairly near to the level of "Common." How this result is to be interpreted it is difficult to say.

To this, as to the rarity of numerous species in a single genus, a merely mechanical explanation suggests itself. The commonness of a species being graded according to the number of collections and their remoteness of locality from one another, the fact that collections are possible in both districts must operate to make the plant seem common, even though a plant is rated very common, if sufficiently abundant in the district climatically suitable. The fact, moreover, that a plant can produce seed under a variety of conditions, and have these seed likely to grow likewise under a variety of conditions, gives it, in the struggle for existence, a material handicap over any plant that can thrive only under comparatively restricted conditions; and this handicap, given sufficient time, will inevitably make the more adaptable plant the commoner.

[8] Ann. Roy. Bot. Gardens Peradeniya 4 (1908) 135.
[9] Variation in California plants, p. 413.

One of Doctor Willis's objections to natural selection (p. 321) escapes me completely:

> Natural selection, again, to be effective, requires that many forms shall modify in the same direction. * * * The most numerous group of the Ceylon endemics are these Very Rares, and the numbers decrease steadily up to Very Common. They must obviously have begun at one or other end of the scale. They could not begin at Very Rare (on the theory of natural selection), because the numbers are insufficient.

I do not believe that natural selection, to be effective, requires that many forms shall modify in the same direction. If "modify" means "vary," I am skeptical as to there being any evidence, proving that many forms ever do this in the same direction. Natural selection, to produce a definite species, requires rather that a fit form maintain its advantageous characteristics *without modification,* while the individuals can become numerous and spread. A single isolated individual, well adapted to its location, may surely become the ancestor of a common species. If the theory of natural selection really required that a species could not come into existence at "Very Rare," but must be very common at its first appearance, it would be a strange theory indeed. It is hardly fair to a theory to impute to it quite that measure of absurdity.

On page 340, Doctor Willis says, "One may conclude that the local endemic species have not been developed in any kind of advantageous response to local conditions." More explicitly, on page 15 of the Annals of the Royal Botanic Gardens, volume IV, he says, "It is at least entirely doubtful if any given species is especially adapted for the circumstances in which it is found." This shows how widely men of training and field experience may differ in their views. For, aside from the distinctive features of possible ephemeral species, I do not believe that there is a plant in the world that does not exhibit adaptation in the whole of its structure, nor which, so far as it is restricted to localities by environmental conditions, fails to be specifically adapted to the local conditions under which it thrives. My paper on the Comparative Ecology of San Ramon Polypodiaceae contains hundreds of illustrations of particular adaptions to particular local conditions. It is not merely that water plants and land plants differ, or that plants restricted to the shade differ from those thriving in open sunshine; but that in genus after genus, where the genus has species under varying conditions, the different species differ from one another in ways that specifically adapt them to their distinctive environments.

If Doctor Willis could see *Stenochlaena areolaris* where it thrives, he would surely be convinced that at least this plant is specifically adapted to its peculiar habitat. It is epiphytic on one species of *Pandanus*. Its adaptation to the very peculiar conditions presented by its "substratum" is such that it can grow nowhere else. Geographically, it is restricted, therefore, to the few square miles where *Pandanus utilissimus* occurs. I expect to describe this most extreme case of adaption at greater length. For the point under discussion here, equally valid evidence is presented by thousands of known species of fungi. Almost every species of parasitic fungus has one host species or a single group of host species, which it is able to attack. Is it imaginable (not to ask for a demonstration) that it is anything except specific adaptation of parasite to host—that is, specific adaptation of the fungus plant to its own peculiar environment—that lets the fungus attack its host, but not the infinitely more numerous other plants growing in the neighborhood? Such a question seems to answer itself.

Finally, the last of Doctor Willis's papers, so far published, deals with the dying out of species, and seeks to show that the extermination that must occur, if natural selection operates in the usually supposed manner, does not occur or seems not to be occurring among the plants of Ceylon. The body of the paper is chiefly a restatement of the facts in the more extensive paper in the Philosophical Transactions, the minor attention, given to the question of dying out, earning one paragraph out of eight in the summary. It may be, as Doctor Willis maintains, that his figures do not furnish any reason to suspect species of being on the downward grade. If there are no species dying out in Ceylon, the number of species in the island must be undergoing a constant increase, and, indeed, this is probably happening. Increase in the number of species must result in a decreased average commonness—that is, abundance in individuals—of all species. Otherwise, the number of individuals in Ceylon is increasing and this is not so probable. If no species is driven to the wall, while the average number of individuals of all species decreases, it is rather strange; but it must certainly be expected that, as many new species are introduced or evolved, and some of these become very common, the disappearance of old species will be comparatively slow. In a study of the flora of four towns in southern Wisconsin,[10] in which particular atten-

[10] Shriner and Copeland. Deforestation and creek flow about Monroe, Wisconsin, *Bot. Gaz.* 37 (1904) 139–143.

tion was paid to the possible disappearance of species in a place where we had the advantage of possessing notes and herbaria prepared in previous decades, the conclusion was reached that five species, none of which had ever been other than strictly local in those towns (by local, I mean confined to single small areas, as single hill-sides or bogs), had been exterminated so far as these towns were concerned. The conclusion reached was:

> It is a most instructive lesson in the survival of what exists that above thirteen-fourteenths of the native habitat has been altogether changed in character, and the other one-fourteenth decidedly modified, without the extinction of a single common forest herb, shrub, or tree.

The chief factor modifying conditions in Ceylon is surely agriculture. With its advance, the existence of the species restricted to such land as is demanded for agriculture must at least be jeopardized. It is hardly possible that there are not during each decade some species lowered in the scale of commonness by clearing and cultivation. The most conspicuous victims of the advance of agriculture are those trees that grow on land of agricultural value. The dominant forest trees of this kind of land throughout the far eastern tropics are the dipterocarps. I have already shown one reason for the rarity of the species of *Doona* and *Stemonoporus*. It seems to me hardly doubtful that the development of agriculture in Ceylon has materially decreased the commonness of these and the species of other dipterocarp genera, and that the existence of some of these trees in the near future will depend upon their deliberate protection by men. Among the peculiarities of the flora of Java, the most outstanding single peculiarity, as compared with that of Borneo, Sumatra, Banca, the Malay Peninsula, or the Philippines, is the limited number of dipterocarps. While seventy-five are known in the Malay Peninsula, and more than one hundred from Borneo, while scantily explored Sumatra has yielded more than thirty, and the Philippines at least seventy-five, Java, botanically better known than any other of these regions, possesses only twelve known species outside of cultivation.

The unquestionable explanation of this extreme scarcity of dipterocarps lies in the use for agriculture of the part of Java suited to dipterocarp forest. It may be that they were never as numerous in Java as in Borneo or even in Sumatra; but that Java contained less species than Banca is incredible. Is it to be supposed that the factors which have cut the dipterocarp species of Java to twelve, while leaving Java with a flora vastly richer

than that of Ceylon in plants whose existence is not so directly menaced by agriculture, will not operate likewise in Ceylon, as the increase of population and the intensification of the use of land brings Ceylon to the point that Java has already reached? Surely, on any well kept plantation in Ceylon, many species once locally common have disappeared. As plantations become more numerous and more extensive and cultivation becomes more intensive, increased rarity and eventual extermination of species, once thriving where agriculture now becomes active, is altogether inevitable. In a sense, this kind of extermination exhibits artificial selection; but artificial selection is never anything but a particular phase of the general process at first distinguished as natural selection. Artificial selection is simply selection in which the will of man is intentionally or incidentally the determining factor.

The validity of the doctrine of natural selection would not be essentially placed in question by the fact that plants are not dying out in Ceylon, even if this were established, unless there were furnished reasons to believe that plants do not die out in general and have not died out in general. That they have died out, everybody knows. Otherwise, where are now the whole groups that, as fossils, we know each year better, which once bridged the gaps between the Pteridophytes of Devonian time and the seed plants? Some good palaeophytogists may tell us how many extinct plants are known this year, but not how many we may know a year or so later. Plants grow rare also, as we know from evidence of the same kind. *Sequoia, Taxodium, Glyptostrobus, Torreya,* and *Cephalotaxus* were once genera of very wide geographical range. The Cretaceous or Miocene botanists would have rated these perhaps as very common. With the passage of time, they have become very rare. *Matonia* represents a group of ferns which for ages was probably world-wide in distribution. It is now known from at least five mountain tops in the Malay Peninsula, Borneo, Sumatra, and Amboina. The dying out of species must be usually a very slow performance, and one that might easily escape attention. We know, though, that it has gone on in geologic time, in early human time (otherwise, where are the wild forms of our common grains?), that it has gone on in recent historic times, in various localities in England, Java, and elsewhere, and it may well be suspected that, at least as agriculture develops in Ceylon, the same process takes place there. However, even if Ceylon conditions are peculiar in this respect, it would be hard to show that natural selection or its failure is responsible for the peculiarity.

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HAWAIIAN FERNS COLLECTED BY J. F. ROCK

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Through the courtesy of Mr. J. F. Rock of the College of Hawaii, I have recently had an opportunity to study the ferns of the College of Hawaii herbarium, and have found among them the following apparently undescribed species. In some groups, especially *Polypodium*, this collection is notably richer than Faurie's,[1] while in other, such as *Asplenium*, it is not so complete. All the specimens here described were collected by Mr. Rock.

ATHYRIUM PSEUDOARBOREUM sp. nov.

Asplenium arboreum Hilleb. non Willd. quid *Athyrium arboreum* Milde.

A. arboreo (Willd.) Milde similis, sed paleis brunneis latioribus prope baseos stipitum, soris longis marginem fere attingentibus, et indusiis latis versus margines suas albidis distinctum, et propter eas indicationes versimiliter phylogenetice diversum.

Lanai, Mahana Valley, in shady, damp places, altitude 770 meters. *Rock 8081.*

There is no question that this is the *Asplenium arboreum* of Hillebrand, page 609, who modified the description, as regards the sori, to fit this fern. But much as the two are superficially alike, *Asplenium arboreum* is a clear-cut member of an American group of species, while *Athyrium pseudoarboreum* represents the Oriental group of *Athyrium japonicum*. *Athyrium kaalaanum* Copel.[2] is also one of this group, but I do not believe it is a juvenile or reduced form of *Athyrium pseudoarboreum;* it has fleshy stipes, a long apex, obtuse pinnae, and short sori. Except for acuminate pinnae and the absence of a gemma, *Athyrium pseudoarboreum* fits Presl's diagnosis of *Diplazium sandwichense*, and I would be tempted to use this name if *Asplenium sandwichianum* were not already in use.

SADLERIA RIGIDA sp. nov.

Caudice ignoto; stipitibus ca. 15 cm longis, validis, ubique densissime paleatis; paleis linearibus, rigidulis, crinitis, rufocastaneis costa spuria castanea, infimis 3 cm longis pallidioribus, sursum usque ad rachides secondarias etenim ad costulas decrescentibus, ibidem costa carentibus; fronde elliptica vel ovata, ca. 33 cm longa, 20–25 cm lata, abrupte acuminata, rhachi dense

[1] Philip. Journ. Sci. 9 (1914) Bot. 435.
[2] Op. cit. 438.

vestita castanea; pinnis medialibus maximis, 13 cm longis, 2 cm latis, imbricatis, acuminatis; segmentis infimis liberis adnatis, aliis anguste confluentibus, 3–4 mm latis, plerumque ob margines involutas angustis, obtusis, integris, rigide coriaceis, superne pilis inferne pilis et paleis angustis fere hyalinis sparse pubescentibus; venis immersis, nigris, trans sorum plerumque simplicibus; soris apices segmentorum fere attingentibus, linearibus, indusiis atrocastaneis.

Kauai, near summit swamp of Waialeale, altitude 1550 meters, legit *Rock*. September, 1909.

This may be the *Sadleria pallida* of Hillebrand and of Christensen's Index, but not *S. pallida* H. & A., of which Hooker[3] says, "It is clearly a trifling variety" (of *S. cyatheoides*), and the Synopsis (p. 18) reads "The original *S. pallida*, H. & A., is a mere form with a paler rachis." Compared with Hillebrand's description, this plant differs in being very dark green above, with veins not prominent though somewhat conspicuous, and sori long and narrow.

Beside a number of specimens from Kauai, Rock sends one from the Haalelepakai Ridge, Lanai.

PTERIS HILLEBRANDII sp. nov.

Eupteris adspectu hybridis P. creticae et P. irregularis; caudice et basi stipitis paleis atrocastaneis nitidis linearibus dense vestito; stipite 30–50 cm alto, stramineo vel castaneo, nitido; fronde 25–40 cm alta, deltoidea; pinnis infimis maximis, stipitatis, ad alam angustam in segmenta pauca linearia deorsum integra apicibus serrulatis pinnatifidis, segmento basiscopico basale solummodo deorsum pinnatisecta lobis paucis; pinnis sequentibus adnatis, 1- vel 2-paribus, suboppositis, paucilobatis; rhachi super pinnas descriptas alata, segmentis superioribus frondis paucis falcatis anguste linearibus, segmento apicale ad basin paucilobata, sursum integra (cauda serrulata excepta), anguste lineare.

Kauai, forests of Kaholuamano above Waimea, in semi-wet region; *Rock 5984, 5983*.

This is *Pteris irregularis* Kaulf. var. *linearis* Hillebrand.[4] Hillebrand's varietal name cannot be used specifically, but the plant is very distinct. *Pteris irregularis* is indeed a very variable fern, as Hooker[5] notes; but even in the simplest forms it shows no tendency, in the many specimens available for study, toward the very long, entire segments of *Pteris Hillebrandii*. In appearance the latter suggests *Pteris heteromorpha* Fée, a smaller fern, even less divided, with finer paleae. Agardh[6] makes a similar observation regarding *Pteris irregularis* and *P. semipinnata* L.

[3] Sp. Fil. 3: 66.
[4] Flora Hawaii 628, from E. Maui.
[5] Species Filicum 2: 173.
[6] Recensio, 19.

ELAPHOGLOSSUM ROCKII sp. nov.

Species gregis E. gorgonei, rhizomate fere 1 cm crasso, cum stipitibus brevissimis et basibus costarum paleis castaneo-ferrugineis anguste linearibus valde crinitis 10-30 mm longis densissime obtectis; fronde 25–40 cm alta, oblanceolata, breviter acuminata, deorsum usque ad basin abrupte truncatam sensim angustata, minute et sparse squamulosa, papyracea (sicca); fronde fertile paullo angustiore, aliter conforme.

Koolau Mountain, Punaluu, *Rock 259, 214.*

This differs from *Elaphoglossum crassicaule* Copel.[1] in its dense mass of brownish paleae, less stout stipe, and less horizontal venation.

Rock's Nos. 212, 215, and 244 differ in having dark chestnut paleae and fronds gradually narrowed below. They may represent still another species; but as more complete collection in the locality where all these were found may close the gap between them, they may stand for the present as varying forms of one kind.

Of *Elaphoglossum Fauriei,* Rock has collected several specimens, all from Molokai.

ELAPHOGLOSSUM HIRTUM (Sw.) C. Chr.

This species is more variable than any description indicates. At one extreme are the most densely scaly plants, with ferruginous rhizomatal paleae, with their tips darker but by no means black. Other very scaly plants have these tips practically black, as described by Hillebrand. At the other extreme are some sparsely scaly plants from Koolau Mountain, Punaluu, with slender stipes and the paleae of the rhizome black throughout. Complete collections would very likely reveal an entire series of intermediate forms. The paleae of the upper surface of the frond are usually paler than those of the nether surface, and this difference sometimes goes so far that the former are clear-white and shining.

POLYPODIUM ROCKII sp. nov.

P. adenophorum, P. sarmentoso affine, stipitibus gracillimus 2–4 cm altis, segmentis remotis decurrentibus linearibus integris, venis costis subparallelis, soris paucis.

Koolau Mountain, Punaluu, *Rock 272.*

Mr. Maxon, of the United States National Museum, has been kind enough to send me photographs of Brackenridge's plate of *Polypodium sarmentosum* and of the type sheet in the National Herbarium, the latter bearing two plants both of which are accurately reproduced on the plate. Of these two, the larger, regarded by Mr. Maxon as the type plant, collected on the mountains back of Honolulu, is surely a freak plant; different as the two appear, they may well represent one species. This is represented by *7074* of the College of Hawaii herbarium, from the Wailau trail, Molokai. The veins leave the costae at an angle much wider than do those of *Polypodium Rockii.* The paleae of the latter are darker, but this difference may not be constant. The specimen of *Polypodium Rockii* shows no "surculi."

[1] Philip. Journ. Sci. 9 (1914) Bot. 440.

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NEW PLANTS FROM SAMAR

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The present paper is devoted to the description of new species of plants from Samar, chiefly from the collections made by M. Ramos and G. Edaño, of the Bureau of Science, in northern Samar in February and March, 1916. Thirty-two new species are proposed and described in the families *Araceae, Urticaceae, Opiliaceae, Aristolochiaceae, Amaranthaceae, Annonaceae, Myristicaceae, Lauraceae, Burseraceae, Meliaceae, Euphorbiaceae, Anacardiaceae, Sapindaceae, Vitaceae, Tiliaceae, Sterculiaceae, Theaceae, Guttiferae, Flacourtiaceae, Myrtaceae, Loganiaceae, Verbenaceae,* and *Acanthaceae.*

Perhaps the most interesting single addition to the Philippine flora is the genus *Petersia* of the *Lecythidaceae,* for which the new generic designation *Petersianthus* is proposed below. The genus was previously known only from tropical Africa, where it is represented by two species. The discovery of a third species of this caracteristic genus in the Philippines is of special interest. It was originally described as a species of *Terminalia,* the material on which it was based presenting only leaves and old fruits. The recently collected Samar material presents two specimens with flowers, so that it has been possible from a study of these to determine its proper position.

ARACEAE

POTHOS Linnaeus

POTHOS ACUMINATISSIMUS sp. nov. § *Allopothos, Longivaginati.*

Scandens, glabra, internodiis 3 ad 7 cm longis; foliis oblongis ad oblongo-lanceolatis, chartaceis, in siccitate pallidis, utrinque minute papillulatis, usque ad 25 cm longis, leviter inaequilateralibus, basi acutis, apice tenuiter caudato-acuminatis, nervis collectivis utrinque 2, tenuibus, lateralibus numerosis; pedunculis solitariis, elongatis, quam petiolo longioribus; spathis oblongis, circiter 6 cm longis et 1.2 cm latis, tenuiter caudato-acuminatis,

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basi distincte decurrentibus; spadicis cylindraceis, sessilibus, circiter 7 cm longis et 8 mm diametro.

Scandent, glabrous, all parts pale when dry. Branches 3 to 5 mm in diameter, the internodes 3 to 7 cm long. Leaves oblong to oblong-lanceolate, chartaceous, 15 to 25 cm long, 4 to 6 cm wide, the uppermost ones sometimes smaller, slightly inequilateral, one side about one-third narrower than the other, base acute, apex slenderly caudate-acuminate, the caudiform part up to 1 cm in length; collective nerves two on each side of the midrib, from or near the base; lateral nerves numerous, slender, about as prominent as the collective ones, up to 40 on each side of the midrib; petioles 5 to 8 cm long, narrowly winged. Peduncles axillary, solitary, about 10 cm long, slightly thickened upward. Spathes oblong, about 6 cm long and 1.2 cm wide, apex slenderly caudate-acuminate, the base distinctly decurrent. Spadices cylindric, about 6 cm long, sessile, obtuse, about 8 mm in diameter, densely many flowered.

SAMAR, Catubig River at Tagabiran, *Bur. Sci. 24125 Ramos*, February 10, 1916, climbing on trees in damp forests at low altitudes.

The alliance of this species is with *Pothos rumphii* Schott and *P. insignis* Engl., from both of which it differs in many characters. It is most closely allied to the latter.

URTICACEAE

LAPORTEA Gaudichaud

LAPORTEA PLATYPHYLLA sp. nov.

Arbor 6 ad 8 m alta, partibus junioribus inflorescentiisque exceptis glabra; foliis chartaceis ad subcoriaceis, ovatis, usque ad 56 cm longis, breviter abrupteque acuminatis, basi leviter cordatis, nervis utrinque circiter 14, prominentibus; paniculis ♂ axillaribus, angustis, circiter 20 cm longis, floribus fasciculatis, sessilibus, 4-meris.

A tree 6 to 8 m high, glabrous except the more or less pubescent younger parts and the very sparingly pubescent inflorescence. Branches stout, the ultimate ones 1 to 1.5 cm in diameter, the petiolar scars large, prominent. Leaves ovate, chartaceous to subcoriaceous, 50 to 65 cm long, 25 to 35 cm wide, rather pale-olivaceous when dry, slightly shining, base somewhat narrowed, slightly cordate, apex abruptly short-acuminate, the lower surface often densely and minutely white-puncticulate on the nerves and reticulations, in age quite glabrous; lateral nerves about 14 on each side of the midrib, prominent, somewhat curved, anastomosing very close to the margin; petioles 9 to 15 cm long. Staminate panicles axillary, numerous, rather narrow, up to 20

cm in length, sparingly pubescent. Flowers white, numerous, sessile, fascicled, 4-merous, the bracteoles slightly pubescent, linear-lanceolate, 2 to 2.5 mm long, the bracts similar but larger, 5 to 8 mm long. Perianth-segments ovate, about 2 mm long. Filaments 3 mm long. Pistillate flowers not seen.

SAMAR, Catubig River at San José, Pinipisakan, and Palapag, *Bur. Sci. 24406 24274* (type) *Ramos, Sablaya 20*, March, 1916, in thickets and in damp forests along streams at low altitudes, locally known as *lingaton*.

A sufficiently characteristic species apparently not very closely allied to any previously known Philippine form, well characterized by its glabrous leaves.

OPILIACEAE

CHAMPEREIA Griffith

CHAMPEREIA PLATYPHYLLA sp. nov.

Frutex circiter 4 m altus, glaber; foliis oblongo-ellipticis, usque ad 25 cm longis et 12 cm latis, coriaceis, in siccitate utrinque verruculosis, acuminatis, basi acutis vel rotundatis et decurrento-acuminatis, nervis utrinque circiter 8, subtus prominentibus; inflorescentiis laxis, usque ad 10 cm longis, sepalis oblongo-ovatis, acutis, 2 mm longis.

A glabrous erect shrub about 4 m in height. Branches and branchlets terete, grayish, the former lenticellate. Leaves oblong-elliptic, 20 to 25 cm long, 9 to 12 cm wide, olivaceous and usually dull when dry, minutely verruculose on both surfaces, apex acuminate, base acute to rounded and decurrent-acuminate, coriaceous or subcoriaceous; lateral nerves about 8 on each side of the midrib, rather prominent on the lower surface, obscurely anastomosing, the primary reticulations very lax, not prominent, the secondary obsolete; petioles stout, less than 1 cm long. Inflorescences axillary, lax, rather many-flowered, up to 10 cm in length. Flowers greenish-white, their pedicels about 4 mm long. Sepals oblong-ovate, acute, 2 mm long. Filaments about 1 mm long.

SAMAR, Catubig River at Camaniwan, *Bur. Sci. 24248 Ramos*, February 12, 1916, on forested slopes at low altitudes.

A species similar in general appearance and in details of its flowers to *Champereia manillana* (Blume) Merr., from which it is readily distinguished by its very large leaves, most of which are from 20 to 25 cm long and about 11 cm wide.

CHAMPEREIA OBLONGIFOLIA sp. nov.

Frutex vel arbor parva, glabra; foliis oblongis, junioribus membranaceis vetustioribus subcoriaceis, usque ad 18 cm longis et 8 cm latis, basi acutis ad acuminatis, sursum gradatim angustatis, longe acuminatis, utrinque verruculosis, nervis utrinque

circiter 10; infructescentiis paniculatis, usque ad 15 cm longis, fructibus ellipsoideis, 12 ad 16 mm longis.

A shrub or small tree, entirely glabrous. Branches and branchlets terete, brownish, grayish, or olivaceous, lenticellate. Leaves oblong, usually olivaceous, sometimes pale when dry, dull or slightly shining, verruculose on both surfaces, gradually narrowed below to the acute or acuminate base and more gradually narrowed upward to the rather slenderly acuminate apex, when young membranaceous, in age subcoriaceous, 13 to 18 cm long, 4.5 to 8 cm wide; lateral nerves about 10 on each side of the midrib, irregular, prominent or rather prominent on the lower surface, obscurely anastomosing, the reticulations subobsolete or obsolete; petioles 5 to 10 mm long. Infructescences from the branches below the leaves, paniculate, up to 15 cm in length, stout, the lower branches up to 7 cm in length. Fruits numerous, ellipsoid, smooth, yellowish-brown or brown when dry, 12 to 16 mm long.

SAMAR, Catubig River at Mount Capatoan, *Bur. Sci. 24882 Ramos* (type), February 19, 1916, on damp forested slopes at low altitudes. Apparently referable here are *Bur. Sci. 24847 Edaño*, from the Catubig River, and *Bur. Sci. 17565 Ramos* from the vicinity of Catbalogan.

Manifestly closely allied to *Champereia manillana* (Blume) Merr., from which it is readily distinguished by its longer, more numerously nerved leaves, larger panicles, and larger fruits. The leaf characters alone distinguish it at once from *Champereia platyphylla* Merr., described above.

ARISTOLOCHIACEAE

ARISTOLOCHIA Tournefort

ARISTOLOCHIA SAMARENSIS sp. nov. § *Diplolobus.*

Ut videtur erecta, novellis inflorescentiisque parce pilosis exceptis glabra; foliis oblongis ad oblongo-ellipticis, membranaceis, nitidis, usque ad 20 cm longis, utrinque subaequaliter angustatis, basi acutis, apice tenuiter acute acuminatis, nervis utrinque circiter 6; racemis axillaribus, brevibus, paucifloris, bracteis ovatis ad oblongo-ovatis, 5 ad 6 mm longis; calycis glabris, utriculis ellipsoideis, circiter 3.5 cm longis, tubo apicali valde refracto, angusto, labio anguste oblongo, ligulato, circiter 4.5 cm longo.

Apparently erect, said by the the collector to be about 1 m high, glabrous except the sparingly pilose younger parts and the inflorescence. Branches subolivaceous, longitudinally striate. Leaves oblong to oblong-elliptic, membranaceous, shining, subolivaceous, 15 to 20 cm long, 6 to 7 cm wide, subequally narrowed to the acute base and to the slenderly acute-acuminate apex; lateral nerves about 6 on each side of the midrib, curved-

ascending, anastomosing, prominent, the reticulations lax, prominent; petioles 6 to 10 mm long. Racemes axillary, sparingly pilose, few-flowered, the rachis not exceeding 1 cm in length, the bracts ovate to oblong-ovate, acute or acuminate, 5 to 6 mm long. Pedicels 2 mm long. Ovarian part of the perianth about 5 mm long, narrowed below, longitudinally 6-ridged, the part above the ovary membranaceous, inflated, the utricular portion ellipsoid, about 3.5 cm long, then abruptly narrowed into the slender, reflexed tube, this narrow portion of the tube 1 to 1.5 cm long, slightly enlarged upward, 1-lipped, the lip narrowly oblong, about 4.5 cm long and 1 cm wide, apiculate-acuminate. Column about 6 mm long, with a short stout stipe, the lobes 6, narrowly oblong, about 3 mm long. Anthers 12, ellipsoid, about 1.5 mm long. Capsule ovoid, prominently ridged, about 1.5 cm long.

SAMAR, Catubig River at Pinipisakan, *Bur. Sci. 24410 Ramos*, March 20, 1916, in damp forests near the river at low altitudes.

A very characteristic species with vegetative characters similar to those of *Aristolochia philippinensis* Warb., but with very much larger, entirely different flowers.

AMARANTHACEAE

CYATHULA Loureiro

CYATHULA LANCIFOLIA sp. nov. § *Telostachys.*

Species *C. prostratae* affinis, differt foliis valde diversis, lanceolatis, usque ad 6 cm longis et 1 cm latis.

Stems elongated, sparingly branched, the lower part prostrate and rooting at the nodes, the flowering branches ascending, the older parts glabrous or sparingly pubescent, the younger parts sometimes fairly densely pubescent with short, subappressed, pale hairs. Leaves membranaceous, olivaceous when dry, lanceolate, 4.5 to 6 cm long, about 1 cm wide, base acute, apex obtuse and usually short-apiculate, margins entire, both surfaces with very few scattered hairs; lateral nerves 7 to 9 on each side of the midrib, slender, anastomosing, the reticulations lax. Racemes simple, terminal, up to 15 cm in length, pubescent. Flowers very similar to those of *Cyathula prostrata*, reflexed, about 3 mm long, their pedicels jointed, 0.5 to 1 mm long, the bracts oblong-lanceolate, acuminate, 1 to 1.5 mm long. Sepals oblong, acuminate, 3-nerved, sparingly appressed-pilose on the back. Spines of the sterile flowers very numerous, 1 to 1.5 mm long, glabrous, hooked at the tip. Utricle ellipsoid, 1.5 mm long.

SAMAR, Catubig River at Tagibiran, *Bur. Sci. 24553* (type), *24514 Ramos*, February, 1916, in damp forests at low altitudes.

A species manifestly closely allied to the widely distributed *Cyathula prostrata* Blume, but with entirely differently shaped leaves. In its inflorescence and floral structure it is very similar to Blume's species.

ANNONACEAE

PAPUALTHIA Diels

PAPUALTHIA SAMARENSIS sp. nov.

Frutex vel arbor parva subtus foliis ad costa ramulisque dense ferrugineo-pubescentibus; foliis oblongis, subcoriaceis, usque ad 15 cm longis, acuminatis, basi cordatis, aequilateralibus vel leviter inaequilateralibus, brevissime petiolatis, nervis utrinque 10 ad 12, subtus cum reticulis primariis prominentibus; floribus solitariis, longissime tenuiterque pedicellatis, circiter 1.5 cm longis, petalis crassissime coriaceis, oblongis, obtusis, extus plus minusve pubescentibus; carpellis circiter 10, anguste oblongis; stigma capitata, leviter hirsuta.

A shrub or small tree, the branchlets, petioles, and the midrib on the lower surface densely ferruginous-pubescent. Branches slender, terete, glabrous, dark-brown or nearly black when dry. Leaves subcoriaceous, generally oblong, sometimes a little wider in the upper part than below, rather pale when dry, somewhat shining, 10 to 15 cm long, 2.5 to 4.5 cm wide, apex prominently acuminate, the acumen blunt, base abruptly rounded, cordate, equilateral or slightly inequilateral, the upper surface smooth, glabrous, pale, the lower somewhat pale-brownish; lateral nerves 10 to 12 on each side of the midrib, very prominent, coarsely anastomosing, the primary reticulations lax, prominent; petioles about 2 mm long. Flowers solitary, in the uppermost axils, their slender glabrous pedicels up to 11 cm in length. Flowers about 1.5 cm long, smaller when immature, pinkish-white. Calyx-lobes broadly ovate, coriaceous, acute, sparingly ciliate, 2.5 to 3 mm long, forming a nearly triangular calyx. Corolla up to 1.5 cm long, the lobes wholly united for the lower 3 to 4 mm, very thickly coriaceous, externally more or less appressed-pubescent in the lower part, the lobes oblong or narrowly oblong, obtuse, up to 12 mm long, 3.5 to 4.5 mm wide. Stamens indefinite, crowded, 1.8 to 2 mm long, the connectives truncate, concealing the anther-cells. Carpels about 10, narrowly oblong, slightly pubescent; style short, slender; stigma obovoid or capitate, somewhat hirsute. Fruit globose, glabrous, dark-brown when dry, shining, about 8 mm in diameter.

SAMAR, Catubig River at Camaniwan, *Bur. Sci. 24180* Ramos, in damp forests at low altitudes, February 3, 1916.

The seventh species of this recently described genus to be found in the Philippines. It is apparently most closely allied to *Papualthia loheri* Merr., but is readily distinguished by its indumentum.

OROPHEA Blume

OROPHEA LEYTENSIS sp. nov.

Frutex 3 ad 4 m altus, partibus junioribus inflorescentiisque exceptis glaber; foliis plerumque oblongis, usque ad 30 cm longis, firme chartaceis, acuminatis, basi subacutis ad rotundatis, nervis utrinque circiter 15; inflorescentiis axillaribus et e axillis defoliatis, dense ciliato-hirsutis, floribus fasciculatis vel in racemis depauperatis dispositis, pedicellis circiter 1 cm longis; sepalis reflexis; petalis interioribus circiter 7 mm longis, breviter unguiculatis, exterioribus 4 ad 5 mm longis, elliptico-ovatis, reflexis; staminibus 5 vel 6; carpellis 6, oblongo-ovatis, hirsutis, sursum angustatis.

A shrub 3 to 4 m high, the younger branchlets and inflorescence densely subappressed-villous with pale-brownish hairs, the older parts quite glabrous. Branches reddish-brown, terete, wrinkled when dry. Leaves generally oblong, 20 to 30 cm long, 7 to 12 cm wide, firmly chartaceous, pale or pale-brownish when dry, base subacute to rounded, apex generally slenderly acuminate, the very young leaves more or less appressed-pilose, in age entirely glabrous; lateral nerves about 15 on each side of the midrib, prominent on the lower surface, somewhat ascending, obscurely anastomosing close to the margin; petioles stout, 3 to 5 mm long. Flowers dull-reddish, axillary, or mostly on the branches from the axils of fallen leaves, the inflorescence densely subappressed-pubescent with pale hairs, of simple fascicles or of fascicled, greatly reduced, short racemes, the bracts ovate to ovate-lanceolate, acuminate, 3 to 3.5 mm long, densely ciliate-pubescent, the pedicels usually about 1 cm long, sometimes shorter. Sepals reflexed before the flower opens, ovate, about 4 mm long, obtuse to acute, pubescent. Outer three petals ovate to ovate-elliptic, obtuse, reflexed, pubescent, about 5 mm long. Inner three petals arched over the stamens and carpels, densely pubescent externally, the claw short, about 2 mm long, the limb rhomboid, about 5 mm long and wide, acute to obtuse. Stamens 5, broadly obovoid, about 1.2 mm long. Carpels 6, oblong or oblong-ovoid, narrowed upward, appressed-pubescent, about 1.5 mm long.

SAMAR, Catubig River at Cagmanaba, *Bur. Sci. 24468* (type), *24292 Ramos*, February 26, 1916, in damp forests at low altitudes. LEYTE, Tacloban, *Wenzel 1723*, April 5, 1916, in forests.

The Samar specimen being much better than the one from Leyte has

been made the type of the species. It is characterized by its comparatively large leaves, and is in the alliance with *Orophea tarrosae* Merr., *O. williamsii* Merr., and *O. submaculata* Elm., from all of which it is readily distinguishable by its larger leaves and more numerous lateral nerves, as well as in its floral characters.

MYRISTICACEAE

KNEMA Loureiro

KNEMA STELLATA sp. nov.

Arbor alta, ramulis junioribus costa subtus petiolis fructibusque dense stellato-ferrugineo-tomentosis; foliis coriaceis, oblongis ad oblongo-lanceolatis, usque ad 23 cm longis, integris, olivaceis, nitidis, subtus pallidis, basi acutis ad rotundatis, apice tenuiter acuminatis, nervis utrinque circiter 25, subtus valde prominentibus; fructibus pedunculatis, ellipsoideis, vel globoso-ovoideis, 1.8 ad 2.3 cm longis, extus densissime ferrugineo-tomentosis.

A tall tree, the very young leaves, the branchlets, the midrib on the lower surface, the petioles, and the entire infructescence densely stellate-tomentose with short ferrugineous hairs. Branches brown, rugose, terete, ultimately glabrous. Leaves coriaceous, oblong to oblong-lanceolate, 14 to 23 cm long, 2.5 to 6 cm wide, entire, gradually narrowed upward to the slenderly acuminate apex, the acumen usually acute, base acute to rounded, the upper surface olivaceous, shining, entirely glabrous, the lower pale, glaucous, the midrib and nerves somewhat brownish, more or less stellate-tomentose; lateral nerves about 25 on each side of the midrib, very prominent on the lower surface, somewhat curved, anastomosing; petioles 1 to 1.5 cm long, stellate-tomentose. Flowers not seen. Infructescences axillary, each with from one to three fruits, all parts densely ferruginous-tomentose, the fruits ellipsoid or ovoid-globose, 1.8 to 2.4 cm long, their peduncles stout, up to 1 cm in length; aril lacerate in the upper one-third.

SAMAR, Catubig River, at Canabaan, Cagmanaba, and Palapag, *Bur. Sci. 24276* (type), *24430 Ramos, Sablaya 52*, February and March, 1916; Ambalate, *Phil. Pl. 1706 Ramos*, April, 1914 (distributed as *Knema stenocarpa* Warb.), in forests at low altitudes.

A characteristic species in many respects resembling *Knema glomerata* (Blanco) Merr. (*K. heterophylla* Warb.), but readily distinguished from this and from other species by its simply stellate-tomentose indumentum.

LAURACEAE

ENDIANDRA R. Brown

ENDIANDRA LAXIFLORA sp. nov.

Arbor circiter 15 m alta, prominente ferrugineo-pubescentibus; foliis coriaceis, nitidis, ellipticis ad oblongo-ovatis, usque ad 30

cm longis, basi acutis, apice prominente acuminatis, nervis utrinque circiter 7, subtus valde prominentibus, reticulis primariis laxis, prominentibus, ultimis utrinque dense jejeune foveolatis; inflorescentiis axillaribus, solitariis, longe pedunculatis, laxis, paucifloris, dense ferrugineo-pubescentibus, usque ad 11 cm longis; floribus junioribus circiter 4 mm longis; fructibus oblongo-ellipsoideis, in siccitate brunneis, circiter 4 cm longis, glabris.

A tree about 15 m high, the branches, branchlets, and inflorescence densely ferruginous-pubescent, the leaves prominently pubescent on the lower surface, the upper surface ultimately glabrous or nearly so. Branches terete, pale or brownish. Leaves coriaceous, brownish or somewhat olivaceous when dry, shining, elliptic to oblong-ovate, apex prominently and usually slenderly acuminate, base acute, 15 to 30 cm long, 9 to 20 cm wide; lateral nerves about 7 on each side of the midrib, very prominent on the lower surface, curved-ascending, anastomosing, the primary reticulations lax, prominent, the ultimate ones close, both surfaces shallowly and densely foveolate; petioles pubescent, 1 to 2 cm long. Inflorescences axillary, lax, peduncled, densely ferruginous-pubescent, rather few flowered, up to 11 cm long, flower-bearing in the upper third. Young flowers densely ferruginous-pubescent, about 4 mm long. Fruits oblong-ellipsoid, hard, dark-brown and glabrous, rounded at both ends, about 4 cm long and 2 cm in diameter.

LUZON, Province of Tayabas, Sampaloc, *For. Bur. 24516 Labitag* (type), *For. Bur. 25423 Duldulao*, April, 1916, in semi-open forests, altitude 300 to 400 meters. SAMAR, Catubig River, *Bur. Sci. 24426, 24280 Ramos*, February, 1916. It is locally known in Tayabas as *malagasaka*.

In many respects this species closely resembles *Endiandra coriacea* Merr. and *E. arborea* Elm., but is distinguished by its larger leaves and especially by its characteristic indumentum.

BURSERACEAE

CANARIUM Linnaeus

CANARIUM SAMARENSE sp. nov. § *Parvifolia.*

Arbor parva, circiter 6 m alta, partibus junioribus plus minusve ferrugineo-hirsutis; foliis usque ad 30 cm longis, foliolis 5 vel 7, firme chartaceis vel subcoriaceis, glabris, nitidis, acuminatis, oblongis, usque ad 20 cm longis, nervis utrinque circiter 11, subtus valde prominentibus; inflorescentiis axillaribus, solitariis, spicatiis, usque ad 20 cm longis vel ♀ sub fructu longioribus; floribus ♂ solitariis vel fasciculatis, 3-meris, circiter 6 mm longis, calycis cupuliformibus, extus plus minusve ferrugineo-hirsutis, lobis acutis; petalis 6 mm longis, sursum leviter pubes-

centibus; filamentis basi connatis; discus nullus; ovarium rudimentarium glabrum, breviter stipitatum; fructibus junioribus anguste ovoideis, circiter 12 mm longis.

A small tree, about 6 m high, glabrous except the younger parts and the sparingly pubescent spikes. Branches slender, terete, glabrous, pale-brownish, the young branchlets usually densely subferrugineous-pubescent. Leaves alternate, up to 30 cm long, glabrous, the leaflets oblong, firmly chartaceous or subcoriaceous, 12 to 20 cm long, 5 to 6 cm wide, entire, olivaceous or greenish when dry, shining and of about the same color on both surfaces, base acute, rarely rounded, apex rather prominently blunt-acuminate; lateral nerves about 11 on each side of the midrib, very prominent on the lower surface as are the primary lax reticulations, curved, anastomosing; petiolules 1 to 1.5 cm long; stipules linear, somewhat curved, stiff, about 5 mm long. Inflorescence a simple, axillary, solitary spike, the staminate ones 10 to 20 cm long, the pistillate ones in fruit up to 30 cm in length, when young more or less appressed-pubescent, in age glabrous or nearly so. Male flowers white, 3-merous, about 6 mm long, scattered or fascicled along the rachis. Calyx cup-shaped, 3 mm long, externally appressed-pubescent, the lobes triangular, acute, at least 1 mm long. Petals 3, oblong, about 6 mm long, 1.2 mm wide, the apical portions sparingly pubescent, imbricate. Disk none. Stamens 6, the filaments united below into a 1 mm long tube, the free portions slender, 2.5 mm long; anthers oblong, 2 mm long. Rudimentary ovary free, ovoid, glabrous, angular, on a short stipe as long as the ovary. Immature fruits narrowly ovoid, about 1.2 cm long, narrowed upward, glabrous.

SAMAR, Catubig River at Cagmanaba, Camaniwan, and at Palapag, *Bur. Sci. 24191* (type), *24149, 24214 Ramos, Bur. Sci. 24879 Edaño*, February and March, 1916, along small streams and on forested slopes at low altitudes, locally known as *pangahauon*.

By definition this species falls in the section *Parvifolia* Engl., but does not resemble the other species placed here; the disk is entirely wanting. In facies it somewhat resembles *Canarium thyrsoideum* Perk., and *C. polyneuron* Perk., differing however in its fewer leaflets, different inflorescences, and very different floral characters.

CANARIUM ROBUSTUM sp. nov.

Arbor alta, ramulis robustis, 1.5 ad 2 cm diametro, densissime ferrugineo-pubescentibus; foliis usque ad 90 cm longis, prominente hirsutis, foliolis chartaceis vel subcoriaceis, ellipticis ad oblongo-ellipticis, integris, usque ad 28 cm longis, abrupte acuminatis, basi late rotundatis vel subcordatis, nervis utrinque 18 ad

25, prominentibus, utrinque hirsutis; racemis fructiferis axillaribus, 12 ad 28 cm longis, pedunculatis; fructibus oblongo-ellipticis, glabris, 3 ad 3.5 cm longis, utrinque subaequaliter angustatis, acutis, obscure vel vix triangularis, in siccitate longitudinaliter subprominente 6-costulatis.

A tall tree, the branches robust, the ultimate branchlets densely ferruginous-pubescent with short hairs, 1.5 to 2 cm in diameter, striate when dry. Leaves alternate, up to 90 cm in length, the petioles, rachis, and petiolules rather densely villous with short spreading hairs, the leaflets on both surfaces prominently hirsute with stiff, spreading, elongated hairs, the stout petioles about 8 mm in diameter at the base and somewhat flattened on the upper surface; leaflets about 10, elliptic to oblong-elliptic, chartaceous to subcoriaceous, entire, greenish-olivaceous when dry, shining, the midribs, nerves, and reticulations on both surfaces copiously supplied with stiff, pale or brownish, spreading hairs, base rounded or somewhat cordate, apex abruptly and rather prominently acute-acuminate; lateral nerves 18 to 25 on each side of the midrib, very prominent on both surfaces, spreading, anastomosing, the primary reticulations prominent; petiolules 3 to 8 mm long; stipules linear-oblong, stiff, curved, densely tomentose, about 7 mm long. Fruiting racemes axillary, ferruginous-pubescent, stout, 12 to 28 cm long, fruit-bearing in the upper one-half only, the fruiting pedicels stout, about 1 cm long, the persistent calyx-lobes triangular-ovate, acute, ferruginous-pubescent, 5 to 7 mm long. Fruits oblong-elliptic, scarcely or not at all 3-angled, 3 to 3.5 cm long, 1.5 to 1.8 cm in diameter, pale-brown when dry, glabrous or with very few, scattered, stiff, brown hairs, subequally narrowed at both ends, the apex acute, longitudinally 6-ridged when dry, the ridges rather prominent, usually also with fainter intermediate ridges.

SAMAR, Catubig River as Tagabiran, and at Palapag, *Bur. Sci. 24512* (type), *24450 Ramos*, February and March, 1916, on forested slopes at low altitudes, locally known as *malapiliay*.

A species in many respects resembling *Canarium racemosum* Merr., of Mindanao, from which it is readily distinguished by its entire, not denticulate leaves; it differs also in numerous other characters, such as its thinner, more acuminate, more hirsute leaflets, and its nearly glabrous fruits. It seems to be less closely allied to *Canarium costulatum* Elm.

MELIACEAE

AGLAIA Loureiro

AGLAIA STENOPHYLLA sp. nov. § *Euaglaia*.

Arbor parva, plus minusve minute stellato-pubescentibus; foliis alternis, usque ad 20 cm longis, foliolis 9 ad 11, alternis, lan-

ceolatis ad anguste lanceolatis, membranaceis, usque ad 22 cm longis et 3 cm latis, tenuiter acute acuminatis, nervis utrinque numerosis, tenuibus; inflorescentiis axillaribus, paniculatis, brevibus, circiter 5 cm longis; floribus minutis, pedicellatis, 5-meris, in ramulis ultimis racemose dispositis, tubo libero; fructibus globosis vel ovoideis, 1.5 ad 2 cm diametro, in siccitate extus densissime rufo-tomentosis.

A small tree, the branches slender, grayish, rugose, glabrous, the branchlets densely ferruginous or subferruginous-pubescent with minute stellate hairs, a similar indumentum on the petioles, rachis, inflorescence, and midribs on the lower surface of the leaflets. Leaves alternate, up to 40 cm in length; leaflets 9 to 11, membranaceous, greenish-olivaceous when dry, the lower surface somewhat paler than the upper, 12 to 22 cm long, 1.5 to 3 cm wide, the apex slenderly and sharply acuminate, the base acute to rounded, sometimes slightly inequilateral; primary nerves 20 to 25 on each side of the midrib, slender, anastomosing, curved; petiolules 2 to 3 mm long. Panicles axillary, solitary, about 5 cm long, narrowly pyramidal, the primary branches few, the lower ones 2 cm long or less. Flowers white, racemosely arranged on the ultimate branchlets, 5-merous, minute, their pedicels 2 to 2.5 mm long. Calyx about 1.5 mm in diameter, the lobes 0.5 mm long, ovate, obtuse, outside densely stellate-pubescent. Petals 5, free, elliptic, glabrous, rounded, concave, about 1.2 mm long. Staminal-tube free, ovoid, truncate, glabrous, about 1 mm long, the five anthers included. Fruit globose or ovoid, reddish-yellow when fresh, the pulp edible, sweet, when dry 1.5 to 2 cm in diameter, the pericarp subcoriaceous, reddish-brown, densely and minutely pubescent; seeds usually two, oblong, about 1.2 cm long.

SAMAR, Catubig River, *Bur. Sci. 24182* Ramos, February 11, 1916, in damp forests at low altitudes.

A most characteristic species, readily distinguishable from all described forms by its narrow, elongated leaflets and its very short panicles. According to C. DeCandolle's arrangment of the species it falls in the group with *Aglaia llanosiana* C. DC., but has little in common with this species or any of the others placed with it.

AGLAIA SAMARENSIS sp. nov. § *Hearnia.*

Arbor parva, ramulis junioribus petiolis inflorescentiisque minute subcupreo-lepidotis; foliis alternis, 14 ad 18 cm longis 2- vel 3-jugis, foliolis subcoriaceis, glabris, oblongo-obovatis ad late oblongo-oblanceolatis, usque ad 9 cm longis, prominente acuminatis, deorsum sensim angustatis, basi cuneatis vel attenuatis, nervis utrinque 8 vel 9, subtus cum reticulis prominenti-

bus; paniculis plerumque axillaribus, laxis, usque ad 12 cm longis; floribus 5-meris, in ramulis ultimis racemose dispositis.

A small tree, about 5 m high, younger parts of the branchlets, petioles, and inflorescences densely and minutely subcupreous-lepidote, the leaflets entirely glabrous. Branches terete, brownish, glabrous. Leaves alternate, 14 to 18 cm long, the leaflets 5 or 7, opposite or subopposite, subcoriaceous, oblong-obovate to broadly oblong-oblanceolate, 6 to 9 cm long, 1.5 to 3.5 cm wide, apex prominently subcaudate-acuminate, the acumen blunt, gradually narrowed from above the middle to the attenuate or cuneate base, the upper surface smooth, grayish-olivaceous when dry, shining, the lower slightly brownish; lateral nerves 8 or 9 on each side of the midrib, prominent, curved, anastomosing, the reticulations lax, prominent on the lower surface; petiolules 3 to 5 mm long. Panicles mostly axillary, peduncled, up to 12 cm long, lax, the branches few, spreading, the lower ones up to 4 cm long, the flowers rather numerous, laxly racemose-cymose on the ultimate branchlets, their pedicels jointed, 1 to 2 mm long. Calyx ovoid, about 1.2 mm in diameter, lepidote, the lobes 5, short, rounded. Petals 5, free, glabrous, orbicular-elliptic, rounded, 1 to 1.2 mm long. Staminal-tube free, turbinate, about 1 mm long, the margin crenulate. Anthers 5 or 6, suborbicular, 0.2 mm long, inserted at the apex of the tube, alternate with the short teeth, inflexed.

SAMAR, Catubig River, Camaniwan, *Bur. Sci. 24197 Ramos*, February 8, 1916, in forests at low altitudes, flowers white.

A species belonging in the same group with *Aglaia affinis* Merr. and *A. diffusa* Merr., differing from the former in its glabrous branches and prominently nerved, differently shaped leaflets. It is readily distinguishable from *Aglaia diffusa* Merr. by its prominent reticulations, and differs also in numerous other characters.

AMOORA Roxburgh

AMOORA FULVA sp. nov. § *Pseudo-Guarea.*

Arbor circiter 12 m alta, prominente fulvo-tomentosa; foliis usque ad 40 cm longis, alternis; foliolis circiter 8, coriaceis, ellipticis ad oblongo-ellipticis, usque ad 18 cm longis, breviter abrupte obtuseque acuminatis, basi rotundatis, costa nervisque utrinque fulvo-villosis; paniculis circiter 20 cm longis, robustis, angustis, multifloris; floribus 4-meris, circiter 1.8 cm longis, sessilibus, in ramis primariis spicatim dispositis, omnibus partibus dense villosis, calycis cupuliformibus, truncatis, stylis quam ovario multo longioribus.

A tree about 12 m high, the branchlets, petioles, midribs, and nerves on both surfaces of the leaves, and the inflorescence

densely fulvous-tomentose. Branches up to 1 cm in diameter. Leaves alternate, up to 40 cm in length; leaflets about 8, opposite, coriaceous, elliptic to oblong-elliptic, 10 to 18 cm long, 5.5 to 8 cm wide, pale-brownish on both surfaces when dry, base rounded, somewhat inequilateral, apex abruptly and shortly blunt-acuminate; lateral nerves 10 to 15 on each side of the midrib, prominent on both surfaces, spreading, curved near the margins, anastomosing; petiolules stout, 3 to 5 cm long, densely fulvous-tomentose. Panicles in the uppermost axils, about 20 cm long, all parts densely tomentose, long-peduncled, narrow, branched in the upper one-half, the branches spreading, 1 to 2 cm long, the flowers somewhat crowded and spicately arranged on the primary branches. Flowers white, tinged with pink, fragrant, 4-merous, about 1.8 cm long in anthesis, cylindric, stout. Calyx cup-shaded, about 7 mm long and wide, truncate, densely villous. Petals 4, oblong, about 1.8 cm long, 6 to 7 mm wide, truncate, coriaceous, outside densely appressed fulvous-villous, inside glabrous, free or nearly so. Staminal-tube cylindric, about 15 mm long, 4 to 5 mm in diameter, densely appressed-pubescent outside, retrorse-villous inside, the apex with 6, oblong, truncate and slightly retuse, 2 mm long lobes. Anthers oblong, alternate with the lobes, 3.5 mm long. Disk a dense ring of short hairs. Ovary ovoid, pubescent, narrowed upward, the style densely pubescent, much longer than the ovary, style and ovary together attaining a length of about 13 mm, the upper two mm of the style quite glabrous; stigma subcapitate. Fruit unknown.

SAMAR, Catubig River at Pinipisakan, *Bur. Sci. 24497 Ramos*, March 21, 1916, in damp forests along the river at low altitudes.

A most characteristic species, readily distinguished by its fulvous indumentum and its narrow, dense panicles, the flowers spicately crowded near the apices of the short primary branches of the inflorescence. It does not appear to be closely allied to any previously described form.

CHISOCHITON Blume

CHISOCHITON CAULIFLORUS sp. nov.

Arbor, ramulis petiolis foliolis subtus ad costa nervisque inflorescentiisque plus minusve fulvo-villosis vel subhirsutis; foliis usque ad 50 cm longis; foliolis circiter 8, oppositis, oblongis, subcoriaceis, usque ad 22 cm longis, acuminatis, nervis utrinque 8 ad 15, prominentibus; inflorescentiis 20 ad 50 cm longis, anguste paniculatis, e truncis et ramis vetustioribus vel interdum e ramulis junioribus; floribus 4-meris, circiter 2 cm longis, calycis cupuliformibus, truncatis, 4 ad 5 mm longis, extus subdense adpresse

fulvo-villosis; petalis extus parce adpresse villosis; antheris 8; tubo libero, truncato, quam petalis paullo brevioribus, extus parce adpresse villoso.

A tree, size not indicated, more or less fulvous-villous or hirsute with usually appressed hairs. Ultimate branches brown, glabrous, up to 1 cm in diameter, the branchlets sparingly fulvous-villous, the very young leaves densely so. Leaves alternate, up to 50 cm in length, the petioles, costa, midrib, and lateral nerves on the lower surface prominently appressed fulvous-villous; leaflets 4 to 8, possibly more on the older branches, oblong, subcoriaceous, brownish when dry, exceedingly variable in size, 10 to 22 cm long, 4 to 5 cm wide, entire, or the younger ones prominently repand-undulate, acuminate, base acute to rounded; lateral nerves 8 to 15 on each side of the midrib, prominent. Inflorescences narrowly paniculate, from tubercles on the trunk and larger branches, sometimes axillary on the young branchlets, 20 to 50 cm long, prominently fulvous-villous, the branches scattered, few flowered, mostly under 4 cm in length, slender. Flowers 4-merous, about 1.8 cm long. Calyx cup-shaped, truncate, 4 to 5 mm long, rather densely appressed fulvous-villous. Petals 4, free or nearly so, about 18 mm long, somewhat spatulate, apical portion rounded, 3 mm wide, outside, especially in the upper part, sparingly appressed-villous. Staminal-tube cylindric, free, about 16 mm long, truncate, outside appressed-villous. Stamens 8, the anthers oblong, 2 mm long. Ovary (rudimentary) very densely villous-hirsute, the style about as long as the staminal tube, appressed-villous in the lower two-thirds, glabrous above; stigma subcapitate.

SAMAR, Catubig River, *Bur. Sci. 24457* (type), *24519 Ramos*, March, 1916, in forests at low altitudes near Las Navas, locally known as *malapauhauli*.

The alliance of this characteristic species is manifestly with *Chisochiton tetrapetalus* Turcz., from which it differs not only in its cauline inflorescence, but also in its prominent indumentum, its larger, fewer flowers, densely villous ovary, petals sparingly villous externally, prominently pubescent truncate calyx, and numerous other characters.

EUPHORBIACEAE

EXCOECARIA Linnaeus

EXCOECARIA STENOPHYLLA sp. nov. § *Commia.*

Frutex glaber, monoicus; foliis alternis, subcoriaceis, integris, lineari-lanceolatis, usque ad 11 cm longis et 1 cm latis, nitidis, obtusis vel leviter acuminatis; inflorescentiis axillaribus, racemis 2 ad 3 cm longis; floribus ♂ numerosis, bracteis 4-glandulosis,

1-floris, sepalis liberis, acutis vel acuminatis, denticulatis, staminibus 3; floribus ♀ paucis, ad basin inflorescentiae vel in racemis brevibus distinctis.

A glabrous monoecious shrub the branches and branchlets terete, brownish. Leaves alternate, linear-lanceolate, subcoriaceous, entire, 6 to 11 cm long, 6 to 10 mm wide, greenish-olivaceous and shining when dry, subequally narrowed to the acute base and to the obtuse to slightly acuminate apex, the margins recurved; lateral nerves 15 to 20 on each side of the midrib, distant, slender, leaving the midrib at right angles. Racemes axillary, 2 to 3 cm long, some all staminate, others with one or two pistillate flowers at the base. Staminate flowers numerous, one to each bract, their pedicels about 0.5 mm long, the bracts broadly ovate, acute to acuminate, about 1 mm long, usually with two small, subbasal glands on each side. Sepals 3, ovate, acuminate, about 1 mm long; the margins slightly lacerate-denticulate. Stamens 3; filaments free, about 1 mm long. Pistillate flowers few, one or two at the base of the staminate raceme or on short separate racemes. Sepals 3, oblong-ovate, acuminate, margins lacerate-denticulate. Ovary ovoid; style arms stout, recurved, 1.5 to 2 mm long. Cocci about 6 mm long, the seeds dark-brown, smooth, shining, ovoid-subglobose, 4 to 5 mm long.

SAMAR, Catubig River at Pinipisakan, *Bur. Sci. 24348 Ramos*, March 21, 1916, on steep forested slopes at low altitudes, locally known as *calipayan*.

A most characteristic species easily distinguished from all described forms by its very narrow, elongated leaves.

TRIGONOSTEMON Blume

TRIGONOSTEMON ACUMINATUS sp. nov.

Frutex circiter 4 m altus partibus junioribus plus minusve adpresse hirsutus exceptis glaber; foliis longe petiolatis, oblongo-lanceolatis ad lanceolatis, usque ad 27 cm longis, basi obtusis ad subacutis, apice longe tenuiterque subcaudato-acuminatis, margine distanter apiculato-serrulatis, nervis utrinque 13 ad 15; inflorescentiis ♀ axillaribus, tenuibus, folia subaequantibus simplicibus vel parce ramulosis, paucifloris, bracteis foliaceis ovatis ad lanceolatis acuminatis usque ad 3.5 cm longis instructis; floribus solitariis, longe pedicellatis, 5-meris.

A shrub about 4 m high, monoecious, the younger parts sparingly appressed-hirsute, otherwise glabrous or nearly so. Branches pale-brownish, terete, glabrous. Leaves alternate, chartaceous, olivaceous when dry, the lower surface paler than the upper, oblong-lanceolate to lanceolate, 16 to 27 cm long, 4 to 8.5 cm wide, base acute or obtuse, apex long and slenderly sub-

caudate-acuminate, margins distantly apiculate-serrate, the teeth sometimes distinct, sometimes obscure; lateral nerves 13 to 15 on each side of the midrib, prominent on the lower surface; petioles 3 to 12 cm long. Pistillate inflorescences axillary, solitary, simple or sparingly branched, up to 40 cm in length, slender, the flowers few, scattered, each subtended by a leaf-like bract, varying from ovate to lanceolate, acuminate, 1.5 to 3.5 cm long. Pedicels thickened upward, about 2 cm long. Sepals 5, oblong, obtuse, 4 to 4.5 mm long, very sparingly appressed-hirsute. Petals 5, free, black-purple, about as long as the sepals, narrowly oblong-obovate, rounded. Ovary ovoid, somewhat pubescent; styles 3, free, cleft, the arms slender, 1.5 mm long. Disk-glands truncate, 0.5 mm long. Capsules ovoid, about 1 cm long, glabrous, composed of three dehiscent cocci.

SAMAR, Catubig River, at Cagminaba, Las Navas, and Camaniwan, *Bur. Sci. 24189, 24528* (type) Ramos, *Bur. Sci. 24890 Edaño*, February and March, 1916, on forested slopes at low altitudes.

This species is manifestly allied to the form described some years ago as *Dimorphocalyx longipes* Merr., which is better placed in *Trigonostemon*. It differs remarkably in its caudate-acuminate, larger leaves and especially in its very prominent, leaf-like bracts. Opportunity is here taken to transfer *Dimorphocalyx longipes* to *Trigonostemon:*

TRIGONOSTEMON LONGIPES (Merr.) comb. nov.

Dimorphocalyx longipes Merr. in Philip. Journ. Sci. 1 (1906) Suppl. 82; Pax & K. Hoffm. in Engl. Pflanzenreich 47 (1911) 33.

LUZON, Province of Bataan, Mount Mariveles, *Whitford 1066, For. Bur. 1801 Borden, For Bur. 17330 Curran:* Province of Laguna, Mount Maquiling, *For. Bur. 13327 Tamesis, For. Bur. 19743 Villamil, For. Bur. 20122 Forestry School:* Province of Rizal, San Isidro and Bosoboso, *Bur. Sci. 13428 Ramos, Merrill 2699.*

ANACARDIACEAE

ONCOCARPUS A. Gray

ONCOCARPUS DENSIFLORUS sp. nov.

Arbor parva, ramulis inflorescentiis fructibusque dense ferrugineo-pubescentibus; foliis subcoriaceis, oblongo-obovatis ad ellipticis, usque ad 15 cm longis, abrupte acuminatis, basi acutis, glabris, supra nitidis, olivaceis, subtus glaucescentibus, pallidis, ad costa nervisque leviter pubescentibus; nervis lateralibus 10 ad 12, patulis, subtus cum reticulis valde prominentibus; paniculis terminalibus, brevibus, anguste pyramidatis, 3 ad 4 cm longis, densissime ferrugineo-villosis; petalis oblongis, extus dense ferrugineo-villosis, intus glabris.

A small tree, the short, terminal, densely flowered panicles and

the fruits uniformly and densely ferruginous-villous. Branches terete, brownish-gray, glabrous, the branchlets rather densely pale brownish- or ferruginous-pubescent, when dry obscurely angled. Leaves subcoriaceous, oblong-obovate to elliptic, 8 to 15 cm long, 4 to 6 cm wide, apex rather abruptly and prominently acuminate, the acumen up to 1 cm in length, blunt, the base acute, the upper surface olivaceous, glabrous, shining when dry, the lower pale, glaucous, sparingly pubescent on the midrib and lateral nerves; lateral nerves 10 to 12 on each side of the midrib, very prominent on the lower surface as are the reticulations, spreading, somewhat curved, uniting directly with the cartilaginous margin; petioles 1 to 1.5 cm long, pubescent. Panicles terminal, narrow, densely flowered, 3 to 4 cm long, all parts very densely ferruginous-villous. Flowers 5-merous. Calyx 3 mm in diameter, the lobes short, ovate, obtuse, less than 1 mm long. Petals 5, free, oblong, 4 mm long, 1.6 mm wide, outside densely ferruginous-villous, inside glabrous, apex obtuse, base narrowed, cuneate. Stamens 5; filaments slender, about 3 mm long. Male flowers with a dense tuft of ferruginous villous hairs in the center. Fruits few, usually 3 or 4 in a panicle, their peduncles about 6 mm long, densely ferruginous-villous, the calyx-tube in fruit about 6 mm long, ovoid-cylindric, the teeth broadly ovate, rounded, about 1.5 mm long, the fruit oblique, when immature about 1.6 cm long, all parts, including the accrecent calyx, densely ferruginous-villous, crowned by the three, short, glabrous styles.

SAMAR, Catubig River, Cagmanaba, *Bur. Sci. 24546 Ramos*, February 29, 1913, in forests at low altitude, locally known as *matapoc*.

A characteristic species manifestly closely allied to *Oncocarpus ferrugineus* C. B. Rob., from which it is easily distinguished by its pubescent branchlets, its fewer-nerved, somewhat smaller leaves, and its short, densely flowered panicles, the young fruits obliquely ovoid or obovoid, scarcely ridged. Probably referable here is *Bur. Sci. 24115 Ramos* from Tagabiran, Catubig River, the leaves of which are more prominently acuminate than in the type, and the branchlets nearly glabrous.

SAPINDACEAE

ALLOPHYLUS Linnaeus

ALLOPHYLUS SAMARENSIS sp. nov.

Frutex subglaber; foliis unifoliolatis, foliolis firme chartaceis, oblongo-ellipticis, usque ad 30 cm longis, utrinque subaequaliter angustatis, basi acutis, apice prominente acuminatis, margine grosse irregulariter lobato-serratis, dentibus acutis; nervis utrinque circiter 11, subtus valde prominentibus cum costa reticulisque

brunneis; petiolo 3.5 ad 5 cm longo; inflorescentiis axiliaribus, petiolo subaequantibus, paucifloris, ramis 1 vel 2, parce pubescentibus.

A subglabrous shrub 1 m high or more, the branches slender, terete, glabrous, lenticellate, grayish-brown. Leaves 1-foliolate, oblong-elliptic, 25 to 30 cm long, 9 to 12 cm wide, firmly chartaceous, shining on both surfaces when dry, quite glabrous or the lower surface obscurely and sparsely puberulent on the midrib and nerves, the upper surface brownish-olivaceous, the lower paler, and nerves, midrib, and reticulations brownish, in rather strong contrast to the surface, subequally narrowed to the acute base and to the prominently acuminate apex, the acumen distantly denticulate, the margins coarsely and irregularly lobed-toothed, sinuses broad, rounded, the teeth acute, up to 1 cm in length, one corresponding to each lateral nerve; lateral nerves about 11 on each side of the midrib, very prominent on the lower surface as are the primary and secondary reticulations; petioles sparingly puberulent, 3.5 to 5 cm long. Inflorescences axillary, somewhat pubescent, about as long as the petioles, with one or two branches. Flowers white, their pedicels 1 to 1.5 mm long. Sepals glabrous or their margins obscurely pubescent, the two outer ones oblong to elliptic, rounded, about 2 mm long and 1 mm wide, the two inner ones orbicular to subreniform, 1.8 to 2 mm long, 2 mm wide. Petals 4, about 1.8 mm long, the limb densely villous inside, subtruncate, triangular-narrowed below, the claw glabrous or nearly so. Stamens 8, their filaments somewhat villous, 1.8 to 2 mm long. Glands prominent, glabrous.

SAMAR, Catubig River, Mount Capatoan, *Bur. Sci. 24402 Ramos*, February 20, 1916, in forests, locally known as *hampapangiay*.

A most characteristic species readily distinguished by its large, coarsely toothed, prominently reticulate, simple leaves and its short, slightly branched inflorescences which are about as long as the petioles. It manifestly belongs in the group of unifoliolate *Allophylus* to which belong the Philippine species *A. unifoliatus* Radlk., *A. simplicifolius* Radlk., and *A. pedunculatis* Radlk., but it is distinct from these and from all other described forms.

VITACEAE

LEEA Royen

LEEA UNIFOLIOLATA sp. nov.

Frutex, partibus junioribus inflorescentiisque exceptis glaber; foliis simplicibus, oblongis, chartaceis, usque ad 27 cm longis, acuminatis, basi acutis, margine crenato-dentatis, nervis utrinque 15 ad 18, subtus valde prominentibus; inflorescentiis subterminalibus, brevibus, confertis, 2 ad 3 cm longis; floribus 4-meris, albis.

A shrub, the younger branchlets somewhat furfuraceous, the inflorescence more or less subferruginous-pubescent, otherwise glabrous or nearly so. Branches terete, dark-colored when dry, the ultimate ones 5 mm in diameter or less. Leaves simple, oblong, chartaceous, 20 to 27 cm long, 8 to 10 cm wide, subequally narrowed to the acute base and to the distinctly acuminate apex, margins distinctly crenate-dentate, the teeth rather small, often glandular, the upper surface dark-olivaceous when dry, slightly shining, the lower much paler, shining; lateral nerves 15 to 18 on each side of the midrib, very prominent, nearly straight, somewhat ascending, anastomosing very close to the margin, the reticulations subparallel, rather close; petioles 3 to 4 cm long. Inflorescence subterminal, short, crowded, 2 to 3 cm long. Flowers 4-merous, white, 6 to 7 mm long. Calyx funnel-shaped or cup-shaped, about 4 mm long, with 4 shallow, rounded lobes, externally slightly pubescent. Corolla-tube about 3 mm long, the lobes 4, reflexed, oblong, acute, 3.5 to 4 mm long. Staminal-tube united with the corolla, exserted about 2 mm above the reflexed petals, crenate. Anthers 4, united with the tube, about 2 mm long. Ovary ovoid, glabrous; style 1.2 mm long.

SAMAR, Catubig River at Pinipisakan, *Bur. Sci. 24878 Edaño*, March 20, 1916, in swampy places along streams at low altitudes.

A most characteristic species, readily distinguished among the unifoliolate species of *Leea* by its oblong, numerously nerved leaves, its short, crowded inflorescences, and its 4-merous flowers. It is apparently allied to *Leea simplicifolia* Z. & M., but is totally different from all known Philippine forms.

TILIACEAE

GREWIA Linnaeus

GREWIA INFLEXA sp. nov.

Arbor, inflorescentiis exceptis glabra vel subglabra; foliis subcoriaceis, oblongo-ovatis ad ovato-ellipticis, usque ad 19 cm longis, breviter obtuseque acuminatis, basi rotundatis vix vel obscure 3-nerviis, olivaceis, nitidis, nervis utrinque 7 vel 8, prominentibus; paniculis axillaribus terminalibusque, usque ad 9 cm longis, prominente simpliciter hirsutis; floribus involucratis, sepalis oblongo-spatulatis, minute tomentosis, circiter 8 mm longis, margine inflexis, petalis nullis.

A tree, nearly glabrous except the prominently hirsute inflorescence and puberulent or tomentose flowers. Branches brownish, terete, glabrous, the younger ones sparingly hirsute with scattered spreading hairs. Leaves subcoriaceous, oblong-ovate to ovate-elliptic, 13 to 19 cm long, 7 to 9 cm wide, olivaceous and shining when dry, the lower surface somewhat brownish, the apex

rather prominently but widely and obtusely acuminate, base rounded, equilateral or nearly so, not or but obscurely 3-nerved, glabrous on both surfaces; lateral nerves 7 or 8 on each side of the midrib, prominent, curved, obscurely or scarcely anastomosing, the reticulations slender, the basal pair scarcely different from the next pair above and not extending to beyond one-fourth or one-third the length of the leaf; petioles 8 to 14 mm long, densely hirsute with simple hairs; stipules oblong, glabrous or slightly pubescent, obtuse, about 7 mm long. Panicles axillary and terminal, rather narrow, up to 9 cm in length, the rachis and branches prominently and densely subferruginous-hirsute with spreading simple hairs, the bracts subtending the branches similar to the stipules but slightly smaller. Flowers in groups of threes terminating the branchlets, each group subtended by an involucre of irregular, ovate to oblong, deciduous, densely puberulent, about 6 mm long bracts, these usually also supplied with a few long, spreading simple hairs externally. Flowers yellow, their tomentose pedicels about 2 mm long. Sepals densely puberulent-tomentose, about 8 mm long, oblong-spatulate, obtuse, margins strongly inflexed throughout. Petals none. Torus short, glabrous below, the margins villous. Stamens about 45, their filaments 4 to 5 mm long. Ovary narrowly-ovoid, about 1.3 mm long, puberulent; style slender, glabrous, about 4 mm long.

SAMAR, Catubig River, at Tagabiran and Mount Capatoan, *Bur. Sci. 24466* (type), *24489 Ramos*, February, 1916, in forests along small streams and on damp slopes at low altitudes. A narrow-leaved form is represented by *Sablaya 17*, from the same region.

The alliance of this species is apparently with *Grewia stylocarpa* Warb., from which it is at once distinguished by its more numerously nerved leaves, which are not or but very obscurely 3-nerved at the base, and its hirsute inflorescences. Superficially it very closely resembles a series of specimens from the Malay Peninsula representing *Grewia latifolia* Mast., but the indumentum of the inflorescence in that species is short and stellate, not of simple hairs, while the floral structure is entirely different.

STERCULIACEAE

STERCULIA Linnaeus

STERCULIA RAMOSII sp. nov.

Arbor alta, ramulis incrassatis, 1 ad 1.5 cm diametro; foliis ovatis, integris, subcoriaceis, brevissime acuminatis, basi subtruncato-rotundatis vix cordatis, 7- vel 9-nerviis, usque ad 25 cm longis, supra glabris, nitidis, subtus pallidioribus, minutissime stellato-puberulis, nervis lateralibus utrinque circiter 10; pani-

culis axillaribus, usque ad 35 cm longis, densissime velutinis, angustis; floribus ♂ infundibuliformibus, circiter 6.5 mm longis, lobis oblongo-ovatis, liberis, acutis, rubris, in siccitate purpureis, extus velutinis, intus dense villosis.

A tall tree, the trunk said to be about 1 m in diameter, the branches and branchlets terete, brown, the latter 1 to 1.5 cm in diameter, marked with large petiolar scars, puberulent. Leaves crowded at the ends of the branchlets, ovate, entire, subcoriaceous, 15 to 25 cm long, 10 to 17 cm wide, the upper surface greenish-olivaceous when dry, glabrous, shining, the lower paler, minutely stellate-puberulent, the minute tufts of hairs scattered, the indumentum not covering the entire surface, apex abruptly and very shortly acuminate, the base truncate-rounded, not cordate, 7- or 9-nerved; lateral nerves about 10 on each side of the midrib, prominent; stipules few, linear, accuminate, deciduous, about 5 mm long; petioles 3 to 12 cm long, puberulent, ultimately glabrous. Panicles axillary, rather numerous, narrow, up to 35 cm in length, all parts densely velutinous with pale-brownish or purplish hairs, the branches scattered, spreading, the lower ones up to 7 cm in length, rather few flowered. Flowers red when fresh, usually purplish when dry, funnel-shaped, 6 to 7 mm long, outside densely velutinous, inside densely villous, the lobes 5, oblong-ovate, acute, 2.5 mm long. Staminal column slender, about 3 mm long; anthers about 10, forming a globose head about 1 mm in diameter.

SAMAR, Catubig River at Cagmanaba, *Bur. Sci. 24549 Ramos* (type), February 28, 1916. LUZON, Province of Camarines, Sagnay, *Bur. Sci. 22138 Ramos*, December 17, 1913, in damp forests at low altitudes, locally known in Samar as *palapangui*.

A species well characterized by its thickened branches, few stipules, rather large, ovate, shortly acuminate, entire leaves which are minutely stellate-puberulent on the lower surface with scattered hairs, and its elongated, lax, densely velutinous panicles. It is perhaps as closely allied to *Sterculia wigmanni* Hochr. as to any other species, but it has very much larger flowers, a different indumentum, and different leaves.

THEACEAE

TERNSTROEMIA Mutis

TERNSTROEMIA PHILIPPINENSIS sp. nov.

Arbor glabra, circiter 15 m alta; foliis crasse coriaceis, nitidis, in siccitate brunneis vel olivaceis, oblongis ad oblongo-oblanceolatis, usque ad 25 cm longis, breviter obtuseque acuminatis, basi angustatis, cuneatis, nervis utrinque circiter 12, indistinctis, pagina inferiore nigro-puncticulatis vel glandulosis; floribus

axillaribus, pedunculis mediocris, 1.5 ad 2.5 cm longis, sepalis petalisque crasse coriaceis; fructibus ovoideis, circiter 7 cm longis; seminibus magnis, oblongis, circiter 4 cm longis.

A tree about 15 m high, entirely glabrous. Branches terete, grayish or brownish, the ultimate ones 5 to 7 mm in diameter. Leaves very thickly coriaceous, oblong to oblong-oblanceolate, or oblong-obovate, 12 to 25 cm long, 4 to 7.5 cm wide, usually dark-brown when dry, sometimes olivaceous, apex shortly and broadly acuminate, base gradually narrowed, cuneate, the lower surface distinctly and minutely black-glandular or puncticulate, sometimes minutely verruculose; lateral nerves about 12 on each side of the midrib, slender, indistinct; petioles stout, 1 to 3 cm long. Flowers axillary, solitary, rather numerous, their pedicels stout, 1.5 to 2.5 cm long. Buds globose, when nearly or quite mature about 1.5 cm in diameter, the sepals orbicular, thickly coriaceous, about 1 cm long. Fruits ovoid, brown when dry, smooth, about 7 cm long and 5 cm in diameter, rounded, the much thickened calyx-lobes persistent, the peduncles not elongated. Seeds oblong, rounded at both ends, about 4 cm long and 2 cm wide.

LUZON, Province of Cagayan, near Aparri, *For. Bur. 15245 Bernardo*, May, 1910: Province of Nueva Vizcaya, Imugan, *For. Bur. 10876 Curran*, December, 1908: Province of Laguna, San Antonio, *Bur. Sci. 20477 Ramos*, (type) February 26, 1913: Province of Rizal, Bosoboso, *Merrill 2692*, June 1903: Province of Camarines, *For. Bur. 10642 Curran*, *For. Bur. 14261 Aguilar*, June, April, 1909. MINDORO, south of Lake Naujan, *For. Bur. 6856 Merritt*, April, 1907. SAMAR, Catubig River, *Sablaya 78*, February, 1916.

This species occurs in the virgin forest at altitudes varying from 15 to 1,200 meters, depending on the region in which it grows. It is well characterized by its comparatively large, thickly coriaceous leaves, and its very large fruits. It differs from *Ternstroemia megacarpa* Merr. in its somewhat smaller leaves, and its much shorter flowering and fruiting peduncles. Local names are given as *arana* (Bicol, Camarines); *barangoy* (Tagalog, Rizal), and *hindang* and *pamentugon* (Visayan, Samar).

GUTTIFERAE

GARCINIA Linnaeus

GARCINIA SAMARENSIS sp. nov. § *Oxycarpus* (?).

Arbor circiter 12 m alta, glabra, ramis ramulisque tenuibus, in siccitate purpureo-brunneis, teretibus vel ramulis obscure angulatis; foliis membranaceis, oblongis, acuminatis, basi acutis, usque ad 9 cm longis, olivaceis, nitidis, nervis utrinque circiter 15, tenuibus; floribus ♂ axillaribus, solitariis vel binis, longe pedicellatis, 4-meris; sepalis suborbicularis, membranaceis, 2.5 mm diametro; petalis oblongis, obtusis, circiter 6.5 mm longis;

antheris numerosis, sessilibus, orbicularis, 2-locellatis, in receptaculum integrum dense confertis. Ovarium rudimentum nullum.

A tree about 12 m high, entirely glabrous, the branches and branchlets slender, dark purplish-brown when dry, terete, or the latter obscurely angled. Leaves oblong, membranaceous, shining, olivaceous, 5 to 9 cm long, 2 to 3 cm wide, subequally narrowed to the acute base and to the rather slenderly blunt-acuminate apex; lateral nerves about 15 on each side of the midrib, very slender, anastomosing, the reticulations lax; petioles slender, 5 to 8 mm long. Staminate flowers axillary, 4-merous, solitary or in pairs, their pedicels slender, somewhat thickened upward, about 1 cm long, each subtended by a pair of linear-lanceolate, acuminate, 1.5 mm long bracteoles. Buds globose. Sepals 4, equal, orbicular or suborbicular, rounded, margins minutely and obscurely ciliate, about 2.5 mm in diameter. Petals 4, in anthesis oblong, spreading, rounded, subcoriaceous, 6 to 7 mm long, 2.5 to 3.5 mm wide. Anthers about 40, on all sides of the entire receptacle, orbicular, 0.5 mm in diameter, 2-celled, laterally dehiscent. Rudimentary ovary none.

SAMAR, Catubig River, Mount Capotoan, *Bur. Sci. 24452 Ramos*, February 20, 1916, along small streams in damp forests.

A species well characterized by its membranaceous leaves and its solitary or paired, long-pedicelled, staminate flowers. It does not appear to be closely allied to any previously described form.

GARCINIA MACGREGORII sp. nov. § *Oxycarpus, Cowa.*

Arbor glabra, 10 ad 15 m alta, ramis ramulisque teretibus; foliis oblongis, membranaceis, olivaceis, nitidis, utrinque subaequaliter angustatis, basi acutis, apice prominente acuminatis, usque ad 12 cm longis, nervis primariis utrinque circiter 10, subtus distinctis, anastomosantibus; floribus axillaribus, fasciculatis, pedicellatis, 4-meris; ♂ antheris circiter 25, oblongo-obovoideis, 0.6 mm longis, in receptaculum integrum dense confertis, ovarium rudimentum nullum; ♀ ovario 5-loculare, stigma prominente papillata.

A glabrous tree 10 to 15 m high, the branches and branchlets rather slender, terete, reddish-brown. Leaves membranaceous, generally oblong, sometimes oblong-elliptic, olivaceous, shining, 9 to 12 cm long, 1.5 to 5 cm wide, glandular-punctate, subequally narrowed to the acute base and to the prominently acuminate apex, the acumen usually about 1 cm long, blunt; lateral nerves about 10 on each side of the midrib, slender, distinct, curved, anastomosing, the secondary veins and primary reticulations

rather distinct. Staminate flowers numerous, their pedicels 2 to 3 mm long, axillary, fascicled. Sepals 2 mm long, ovate, rounded. Petals subcoriaceous, oblong-elliptic, rounded, 4 mm long. Anthers about 25, oblong-obovoid, 0.6 mm long, crowded on the flat receptacle. Rudimentary ovary none. Pistillate flowers axillary and terminal, solitary or fascicled, sometimes on a short peduncle, their pedicels 2 to 3 mm long. Sepals broadly orbicular-ovate to subreniform, rounded, 1.5 mm long. Ovary depressed-globose, 5-celled. Rudimentary stamens about 12, their filaments free or nearly so, flattened, 1 mm long. Stigma obscurely 5-lobed, rounded, about 2 mm in diameter, prominently papillate. Fruit immature, apparently globose, fleshy, black when dry, 1.5 cm in diameter or more.

SAMAR, Catubig River (Palapag) *Bur. Sci. 24279 Ramos* (type), March 12, 1916, *Sablaya 59*. BILIRAN, *Bur. Sci. 18551 McGregor*, June, 1914, in forests, altitude about 300 meters.

The alliance of this species appears to be with *Garcinia nigro-lineata* Planch., from which, however, it is distinguished by numerous characters, notably in its much fewer lateral nerves.

FLACOURTIACEAE

HOMALIUM Jacquin

HOMALIUM SAMARENSE sp. nov. § *Myriantheia*.

Arbor circiter 10 m alta, inflorescentiis prominente ciliatis exceptis glabra; foliis ellipticis vel oblongo-ellipticis, usque ad 10 cm longis, coriaceis vel subcoriaceis, in siccitate nitidis, brunneis vel olivaceo-brunneis, basi acutis ad subrotundatis, apice breviter acute acuminatis, margine distanter crenato-serratis, dentibus subtus glandulosis, nervis utrinque circiter 6, subtus prominentibus; inflorescentiis terminalibus, ramis paucis, elongatis, valde ciliatis; floribus 6-meris, sepalis linearis, 4 ad 5 mm longis; petalis anguste spatulatis, sepalis aequantibus, ciliatis; staminibus 18.

A tree about 10 m high, glabrous except the prominently ciliate inflorescence. Branches terete, slender, lenticellate, brownish-gray. Leaves mostly brown when dry or the upper surface brownish-olivaceous, shining, coriaceous or subcoriaceous, elliptic to oblong-elliptic, 7 to 10 cm long, 3.5 to 5 cm wide, base rounded to acute, apex shortly acute-acuminate, margins distantly crenate-serrate, each tooth with a gland on the lower surface; lateral nerves about 6 on each side of the midrib, prominent, anastomosing, the reticulations distinct; petioles 5 to 8 mm long. Racemes terminal, sometimes solitary, sometimes arranged in a depauperate panicle supplied with reduced

leaves, up to 10 cm long, prominently ciliate with long, spreading, pale hairs. Flowers white, 6-merous, scattered, not fascicled, along the rachis, their prominently ciliate pedicels about 3 mm long, jointed to the calyx, the flower readily falling, the subtending bracts linear-lanceolate, 2.5 to 3 mm long, ciliate. Calyx-tube funnel-shaped, about 2 mm long. Sepals 6, linear, 4 to 5 mm long, ciliate. Petals 6, narrowly spatulate, ciliate, as long as the sepals. Stamens 3 opposite each petal, their filaments 5 mm long, prominently ciliate in the lower one-half. Ovary ovoid, ciliate; styles 6, about 5 mm long, hirsute-ciliate in the lower one-half with spreading hairs.

SAMAR, Catubig River, *Bur. Sci. 24188 Ramos*, in damp forests at low altitudes, February 13, 1916.

Most closely allied to *Homalium villarianum* Vid., from which it is readily distinguished by its sepals not being at all spatulate but linear, as well as by other characters.

LECYTHIDACEAE

PETERSIANTHUS nomen novum

(*Petersia* Welw., 1867, non Klotzsch, 1861)

PETERSIANTHUS QUADRIALATUS (Merr.) comb. nov.

Terminalia quadrialata Merr. in Philip. Journ. Sci. 4 (1909) Bot. 301.

MASBATE, *Bur. Sci. 12558 Rosenbluth*, type, in fruit, *Bur. Sci. 12814, 12597* (fruits and seedlings), *12562* (old fruits), *12583 Rosenbluth*. SAMAR, *Bur. Sci. 24146 Ramos*, February, 1916, *For. Bur. 24746 Phasis*, November 19, 1915, both in flower, *For. Bur. 12874, 12617 Rosenbluth*, both sterile. LUZON, Province of Sorsogon, *For. Bur. 4526 Zschokke*, May, 1906, with old fruits. MINDANAO, Subprovince of Butuan, *For Bur. 18865 Varian*, *For. Bur. 7556 Hutchinson, Sherfesee s. n.*, all sterile.

This species is widely distributed in the central and southern Philippines, and is widely known as *toog* (Sorsogon, Samar, Masbate, and Butuan). The tree reaches an enormous size, one cut and measured at Amparo, Butuan Subprovince by Mr. Varian, presenting a trunk with a diameter of 186 cm at 2 meters above the ground, and a length of 35 meters to the first branch.

The species was first described from fruiting specimens and was erroneously placed in *Terminalia*. Now that flowers are available for study, it is clearly referable to the African genus *Petersia* Welw., which I have here renamed *Petersianthus*, as *Petersia* is a name preoccupied by Klotzsch's genus of the *Capparidaceae*. A description of the flowers is as follows:

Inflorescence terminal, peduncled, corymbose-paniculate, including the peduncle about 10 cm long, sometimes supplied with dwarfed leaves. Flowers white, their pedicels about 3 mm long. Calyx-tube sharply 4-angled or narrowly 4-winged, gradually enlarged upward, about 6 mm long, the lobes 4, alternate with the angles, orbicular, rounded, imbricate, 4 to 5 mm in diameter. Petals 4, orbicular-ovate, rounded, about 1 cm

long. Stamens many-seriate, subequal, their filaments up to 1 cm in length; anthers elliptic, longitudinally 2-celled, 1 to 1.2 mm long, opening by longitudinal slits. Ovary inferior, 4-celled; ovules several seriate, axile; style slender, about 6 mm long.

The discovery of a third species of this typically African genus, in the Philippines, while unexpected, is by no means the only case of special extra-African distribution presented by the Philippine flora. We have in the Philippines one representative of the almost exclusively African genus *Angraecum* (*A. philippinense* Ames), and one representative of the almost exclusively African and Madagascar genus *Erythrophloeum* (*E. densiflorum* Merr.).

The other known species of *Petersianthus* are:

PETERSIANTHUS AFRICANUS (Welw.) comb. nov.

Petersia africana Welw. ex Benth. & Hook. f. Gen. Pl. 1 (1867) 721.

PETERSIANTHUS MINOR (Niedenzu) comb. nov.

Petersia minor Niedenzu in Engl. & Prantl Nat. Pflanzenfam. 3 (1892) 31, *f. 12.*

MYRTACEAE

EUGENIA Linnaeus

EUGENIA TULANAN sp. nov. § *Eueugenia.*

Arbor circiter 15 m alta, glabra, ramis ramulisque teretibus; foliis oppositis, coriaceis vel subcoriaceis, in siccitate olivaceis vel pallide brunneis, ellipticis at oblongo-ellipticis, usque ad 9 cm longis, breviter obtuseque acuminatis, basi acutis, tenuiter triplinerviis, subtus parce puncticulatis, nervis lateralibus utrinque 6 ad 8, tenuibus, anastomosantibus, reticulis obscuris; floribus axillaribus vel e axillis defoliatis, solitariis vel fasiciculatis, brevissime pedicellatis, circiter 2.5 cm diametro, calycis lobis subpersistentibus, patulis, glandulosis, orbiculari-ovatis, rotundatis, circiter 6.5 mm diametro.

A tree about 15 m high, entirely glabrous, or the inflorescence very obscurely pubescent. Branches and branchlets terete, smooth, pale or brownish when dry, slender. Leaves opposite, coriaceous or subcoriaceous, olivaceous or pale-brownish when dry, shining, the lower surface sparingly puncticulate, paler than the upper, 5 to 9 cm long, 3 to 4.5 cm wide, elliptic to oblong-elliptic, subequally narrowed to the acute base and to the shortly blunt-acuminate apex, the base 3-plinerved, the nerves slender, distant about 5 mm from the margins, continuing to the apex; lateral nerves 6 to 8 on each side of the midrib, slender, anastomosing with the marginal nerves, the reticulations obscure; petioles 4 to 5 mm long. Flowers white, fragrant, axillary or in the axils of fallen leaves, solitary or fascicled, their pedicels short, stout, about 1.5 mm long, jointed to the pseudo-stalk; bracteoles ovate, slightly pubescent, 1.5 mm long. Calyx-tube,

including the pseudo-stalk, about 4 mm long, narrow below, above abruptly widened and 6 to 7 mm in diameter, the lobes glandular-punctate, in anthesis sparingly ciliate on the margins, orbicular-ovate, rounded, spreading, subpersistent or persistent. Petals 4, about 1 cm long, elliptic to elliptic-obovate, rounded, rather prominently nerved. Stamens indefinite, their filaments about 1 cm long.

SAMAR, Catubig River at Pinipisakan and at Palapag, *Bur. Sci. 24453* (type), *24421 Ramos*, March, 1916, in damp forests at low altitudes, locally known as *tulanan*, the wood very hard.

The alliance of this species is with *Eugenia aherniana* C. B. Rob. from which it is readily distinguished by its glabrous or nearly glabrous inflorescence and much larger flowers. From *Eugenia kamelii* Merr. it is readily distinguished by its much smaller leaves and by numerous other characters.

LOGANIACEAE

STRYCHNOS Linnaeus

STRYCHNOS WENZELII sp. nov.

Frutex scandens, inflorescentiis leviter adpresse ferrugineo-pubescentibus exceptis glaber; foliis chartaceis, in siccitate utrinque castaneis valde nitidisque, ellipticis ad oblongo-ellipticis, usque ad 15 cm longis, breviter acuminatis, basi subacutis ad rotundatis, 5-pli- vel 5-nerviis; inflorescentiis axillaribus, pedunculatis, 1.5 ad 3 cm longis; floribus 3 mm longis, extus glabris, lobis intus ad basin linea dense hirsuta instructis; antheris basi leviter barbatis; fructibus ellipsoideis, brunneis, laevis, nitidis, circiter 1 cm longis, monospermis.

A scandent shrub, attaining a length of 10 m, entirely glabrous except the sparingly appressed ferrugineous-pubescent inflorescence. Branches and branchlets slender, terete, smooth, shining, dark-brown when dry. Leaves chartaceous, elliptic to oblong-elliptic, 7 to 15 cm long, 4 to 8 cm wide, when dry chestnut-brown and strongly shining on both surfaces, base acute to rounded, apex shortly blunt-acuminate; basal nerves 5, the inner pair more prominent than the outer, all leaving the midrib at or near the base or the inner pair up to 1 cm above the base, the reticulations lax, distinct; petioles 5 to 8 mm long. Cymes axillary, peduncled, including the peduncle 1.5 to 3 cm long, sparingly appressed-ferruginous-pubescent, the bracts 2 to 2.5 mm long, the bracteoles smaller. Flowers green and white, rather numerous, 5-merous, their pedicels about 2 mm long. Sepals broadly ovate, rounded or slightly apiculate, about 1 mm long, margins slightly ciliate. Corolla-tube about 1.8 mm long, glabrous, the lobes oblong-ovate, obtuse, about 1.2 mm long,

glabrous outside, inside at the throat supplied with a dense line of stiff hairs about as long as the lobe. Anthers 1 mm long, base sparingly retrorse-bearded. Ovary ovoid, glabrous, somewhat longer than the style. Fruit ellipsoid, brown, smooth, shining when dry, about 1 cm long, the pericarp crustaceous. Seed solitary, somewhat hemispheric, flattened on one side, about 8 mm long.

LEYTE, near Tacloban, *Wenzel 1319* (type), *1569*, and two sheets without number, flowering in June, fruiting in February, 1915. SAMAR, Catubig River at Mount Capatoan, *Bur. Sci. 24381 Ramos*, February 20, 1916, in fruit.

The species grows in forests at low and medium altitudes, and is known in Samar as *mara igasud*, and in Leyte as *igasud*, the latter being the proper name of the entirely different *Strychnos ignatii* Berg. *Strychnos wenzelii* Merr. is a very distinct and characteristic species, readily distinguishable by its castaneous, strongly shining leaves, and its small, one-seeded fruits. Its alliance is with *Strychnos horsfieldiana* Miq., from which, however, it differs in many details, its leaves not attenuate-acuminate, 5-nerved rather than 3-nerved, quite glabrous beneath, its glabrous branches and branchlets, and its corolla entirely glabrous externally.

VERBENACEAE

PREMNA Linnaeus

PREMNA STELLATA sp. nov.

Arbor 5 ad 10 m alta, subtus foliis ad costa nervisque petiolis inflorescentiisque plus minusve cinereo- vel subferrugineo- simpliciter stellato-tomentosis; foliis chartaceis, ovatis ad oblongo-ovatis, usque ad 20 cm longis, integris, nitidis, apice abrupte acuminatis, basi late rotundatis ad subtruncatis, nervis utrinque 4 ad 6, subtus valde prominentibus; inflorescentiis terminalibus, corymbosis, pedunculatis, usque ad 11 cm latis; floribus extus stellato-tomentosis, calycis obscure bilabiatis, subaequaliter 5-dentatis; corolla 5 mm longa, labium superius cucullatum, orbiculari-rotundatum, usque ad 2.5 mm diametro, inferius trifidum.

A tree 5 to 10 m high, the branchlets densely stellate-tomentose, the leaves on the lower surface, especially on the midrib and lateral nerves rather sparingly so, the inflorescence distinctly, and when young, densely stellate-tomentose. Branches terete, or the younger ones compressed, pale-brownish, glabrous, the branchlets stellate-tomentose, all the hairs stellate, no plumose and no simple ones intermixed. Leaves chartaceous, pale or olivaceous when dry, somewhat shining, ovate to oblong-ovate, entire, 9 to 20 cm long, 7 to 12 cm wide, the apex abruptly acuminate, the acumen blunt or acute, 1 cm long or less, the base broadly rounded or subtruncate, not cordate, the upper

surface glabrous, or the midrib and lateral nerves slightly stellate-tomentose; lateral nerves 4 to 6 on each side of the midrib, very prominent on the lower surface, somewhat ascending, anastomosing, the reticulations distinct; petioles 2.5 to 6 cm long, stellate-tomentose. Panicles terminal, corymbose, peduncled, up to 11 cm in diameter, the lower branches 4 to 6 cm in length. Flowers white, numerous but not crowded, the subtending bracteoles linear, 1 to 2 mm long, the bracts similar but much larger, the pedicels 1 to 2 mm long, jointed to the calyx. Calyx cup-shaped, about 3 mm long, externally rather densely stellate-tomentose with cinereous hairs, obscurely 2-lipped, subequally 5-toothed, the teeth 0.5 to 0.8 mm long, acute. Corolla 5 mm long, the upper part externally stellate-tomentose, eglandular, 2-lipped, the upper lip entire, rounded, cucullate, suborbicular, 2 to 2.5 mm in diameter, the lower 3-lobed, the central lobe elliptic-ovate, rounded, about 1.8 mm long, the two lateral ones slightly shorter. Ovary tomentose. Filaments glabrous. Fruit ellipsoid-obovoid, about 4 mm long, when young stellate-tomentose, ultimately glabrous.

SAMAR, Catubig River, *Bur. Sci. 24262 Ramos* (type), February 7, 1916, *Sablaya 96;* Catarman, *For. Bur. 12643 Rosenbluth,* April 9, 1909, along streams in forests at low altitudes, locally known as *manaba.*

A species manifestly allied to *Premna cumingiana* Schauer, from which it is readily distinguished by its simply stellate, comparatively sparse indumentum. In *Premna cumingiana* the indumentum on many parts is distinctly plumose, while on some parts the plumose hairs are intermixed with much longer simple ones; the lower surface of the leaves is very densely and uniformly covered with indumentum, while in the present species the indumentum is practically confined to the midrib and lateral nerves. *Premna stellata* Merr. is also closely allied to the Javanese form that has been referred to *Premna tomentosa* Willd., the oldest name for which appears to be *Cornutia corymbosa* Burm., based on Ceylon specimens. It is not the same as the Javan plant, however, differing in its abruptly acuminate, fewer-nerved leaves. It is also sufficiently distinct from the Asiatic *Premna pyramidata* Wall.

ACANTHACEAE

HEMIGRAPHIS Nees

HEMIGRAPHIS OBLONGIFOLIA sp. nov.

Caulis simplicibus, rariter ramosis, infra prostratis, radicantibus, usque ad 25 cm altis, prominente patule ciliatis; foliis in paribus aequalibus, oblongis, membranaceis, usque ad 8 cm longis, obtusis, basi rotundatis ad leviter cordatis, margine grosse crenatis, utrinque plus minusve ciliatis vel ciliato-setosis; inflorescentiis axillaribus terminalibusque, tenuiter pedunculatis,

bracteis parce ciliato-hirsutis, spatulatis, circiter 1 cm longis; sepalis lineari-lanceolatis, tenuissime acuminatis, ciliato-setosis, 7 ad 8 mm longis; corolla circiter 1 cm longa.

A rather slender, simple, rarely branched, prominently pubescent annual attaining a height of 25 cm, the stem prostrate below, rooting at the nodes, prominently ciliate with elongated, spreading, rather pale, weak, crisped or jointed hairs. Leaves of each pair equal or subequal, mostly oblong, rarely ovate or ovate-oblong, membranaceous, olivaceous when dry, dull or somewhat shining, 3 to 8 cm long, 1.5 to 3 cm wide, apex rounded or obtuse, base abruptly rounded or truncate, sometimes slightly cordate, both surfaces supplied with numerous, long, rather weak, spreading hairs, margins prominently and rather coarsely crenate; petioles ciliate, 5 to 25 mm long. Inflorescences axillary and terminal, their peduncles slender, ciliate, 1.5 to 7 cm long, the flowers white, rather few, crowded near the top of the peduncle; bracts spatulate, obtuse, narrowed below, about 1 cm long, the lowermost ones often larger and foliaceous, ciliate or ciliate-setose with long, scattered, spreading hairs. Sepals 5, linear-lanceolate, slenderly long-acuminate, 7 to 8 mm long, sparingly ciliate with long, slender, white or pale hairs. Corolla about 1 cm long, glabrous. Capsule narrowly oblong, 8 to 9 mm long, about 1.8 mm in diameter, glabrous or very slightly puberulent.

SAMAR, Catubig River at Caminiuan and at Palapag, *Bur. Sci. 24240* (type), *24185, 24301 Ramos*, February and March, 1916, in damp forests at low altitudes.

A species well characterized by its oblong, crenate leaves and its indumentum.

RUNGIA Nees

RUNGIA MEMBRANACEA sp. nov.

Annua, usque ad 35 cm alta, caulibus infra prostratis, radicantibus; foliis membranaceis, lanceolatis usque ad 9 cm longis, basi acutis vel acuminatis, sursum gradatim angustatis, apice obtusis, lineolatis, glabris, vel subtus ad costa plus minusve hirsutis, nervis utrinque 5 vel 6, distinctis, adscendentibus, anastomosantibus; spicis axillaribus terminalibusque, solitariis ad trinis, usque ad 3 cm longis, bracteis haud marginatis, orbiculari-ovatis ad late obovatis, abrupte brevissime acuminatis, reticulatis, margine leviter ciliatis; bracteolis oblongo-lanceolatis, circiter 5 mm longis, anguste acuminatis, margine parce ciliatis; calycis segmentis anguste lanceolatis, acuminatis, ciliatis, circiter 3.5 mm longis.

An annual, simple or sparingly branched, nearly glabrous herb

35 m high or less, the stems sparingly pubescent, the lower parts prostrate and rooting at the nodes. Leaves membranaceous, lanceolate, greenish when dry, 6 to 9 cm long, 1.5 to 2.5 cm wide, base acute or acuminate, gradually narrowed upward to the blunt apex, margins slightly undulate, both surfaces with numerous small cystoliths, glabrous, or the midrib on the lower surface more or less hirsute with short hairs; lateral nerves 5 or 6 on each side of the midrib, distinct, ascending, anastomosing; petioles 8 to 20 mm long. Spikes terminal and axillary, solitary or in threes, shortly peduncled, up to 3 cm long. Bracts submembranaceous, green, not margined, orbicular-ovate to broadly obovate, 6 to 7 mm in diameter, or the obovate ones up to 8 mm in length, their margins sparingly ciliate, apex abruptly and very shortly acuminate; bracteoles oblong-lanceolate, slenderly acuminate, margins sparingly ciliate, about 5 mm long. Calyx segments narrowly lanceolate, acuminate, ciliate, about 3.5 mm long. Corolla sparingly pubescent externally.

SAMAR, Catubig River at Tagabiran, *Bur. Sci. 24515 Ramos*, February, 1916, in open forests at low altitudes.

A characteristic species distinguished by its membranaceous leaves and its relatively very broad bracts, which are abruptly short-acuminate and not at all margined as in most other species of the genus.

[Vol. XI, Sec. C, No. 3, including pages 101 to 146, was issued August 2, 1916.]

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